The TOOL & DIE Journal
Tool-Die-Machine PROGRESS

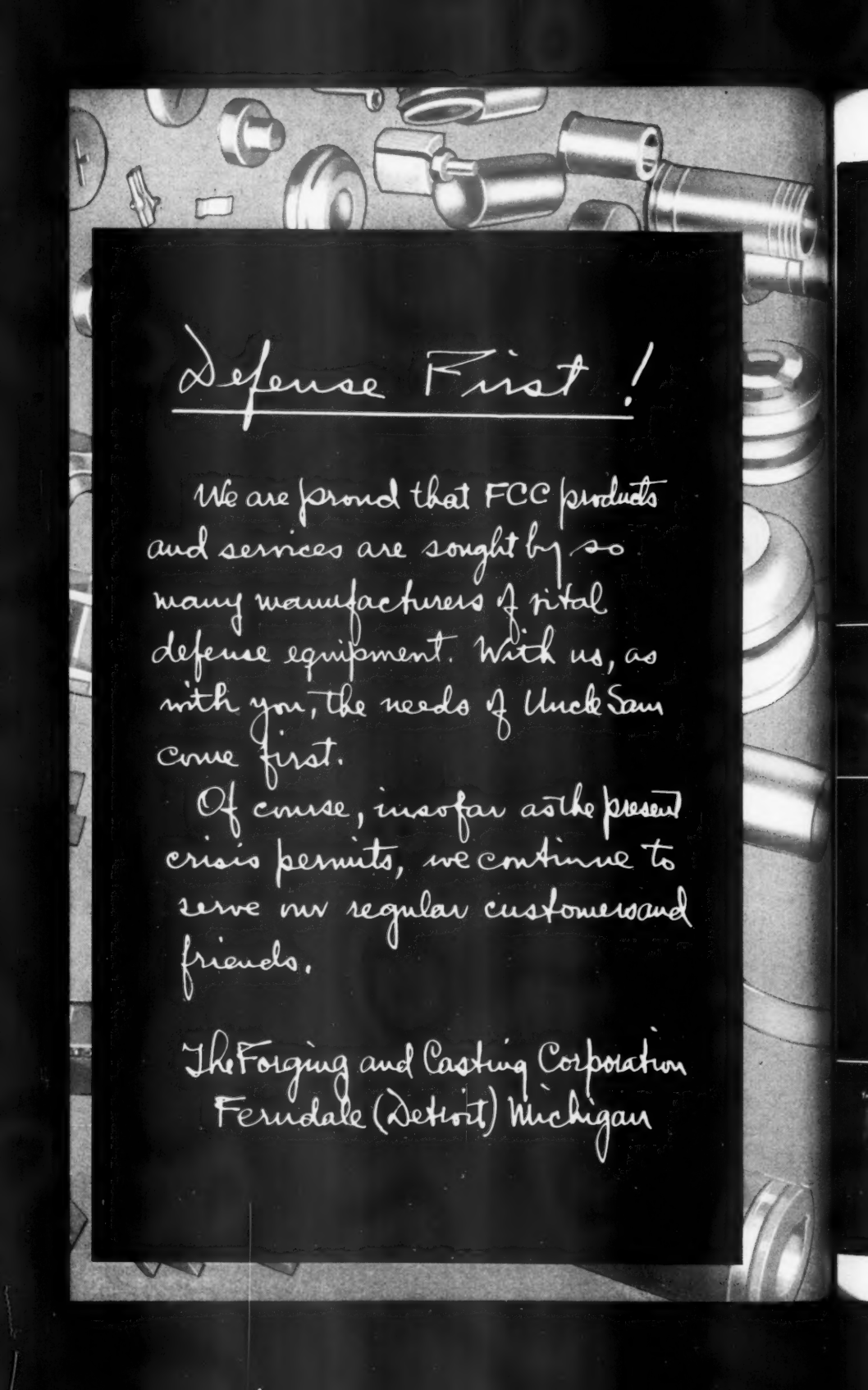
# END MILLS
## from Putnam's MODERN PLANT

For work such as this—the milling of a master cam on a Milwaukee Rotary Head Tool and Die Milling Machine—the use of Putnam Hi-Speed End Mills makes possible a cutting speed which produces an exceptional finish with the milling operation alone.

On thousands of other jobs, Putnam End Mills have demonstrated their ability to cut faster and last longer. It is for that reason that, in only seven years, they have reached the top in acceptance . . . and a new, modern plant has been completed to provide the facilities necessary to meet the ever-increasing demand for them.

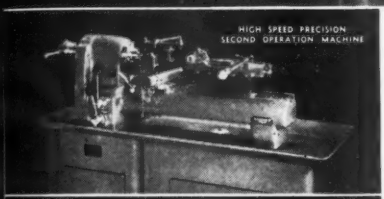
## PUTNAM *Hi-Speed* END MILLS

PUTNAM TOOL CO. • 2985 Charlevoix Ave. • Detroit

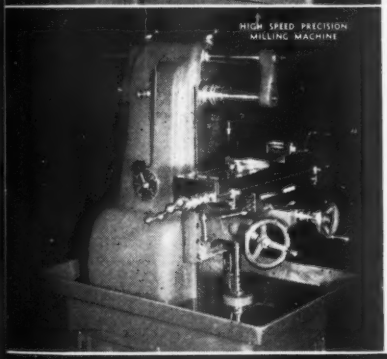

Defense First!
We are proud that FCC products and services are sought by so many manufacturers of vital defense equipment. With us, as with you, the needs of Uncle Sam come first.
Of course, insofar as the present crisis permits, we continue to serve our regular customers and friends.
The Forging and Casting Corporation
Ferndale (Detroit) Michigan

# HARDINGE

HIGH SPEED PRECISION LATHE



HIGH SPEED PRECISION SECOND OPERATION MACHINE



HIGH SPEED PRECISION MILLING MACHINE

## WORTH REMEMBERING

(No. 1 OF A SERIES)

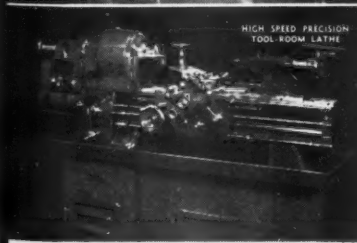
Today's extremely close tolerances and the requirement for high speed production have shown the real value of Hardinge High Speed Precision Machine Tools.

The use of the machines illustrated has expanded tremendously because of their ability to do, BETTER and FASTER, the work which was formerly done with larger machines.

Efficiency is essential in the present emergency because of needed production, but isn't it true, when costs and results are considered, that efficiency in machining operations is always important?

Many organizations were acquainted with the features of the Hardinge High Speed Precision Machine Tools and many were not. But, most organizations NOW realize the logic of using the proper size machine in relation to the work.

For the future, make certain that your range of production work is always efficiently manufactured—such a plan should incorporate Hardinge High Speed Precision Machine Tools.



HIGH SPEED PRECISION TOOL-ROOM LATHE

## HARDINGE BROTHERS, INC.

ELMIRA, N. Y.

"Performance has established leadership for Hardinge"

The TOOL & DIE Journal

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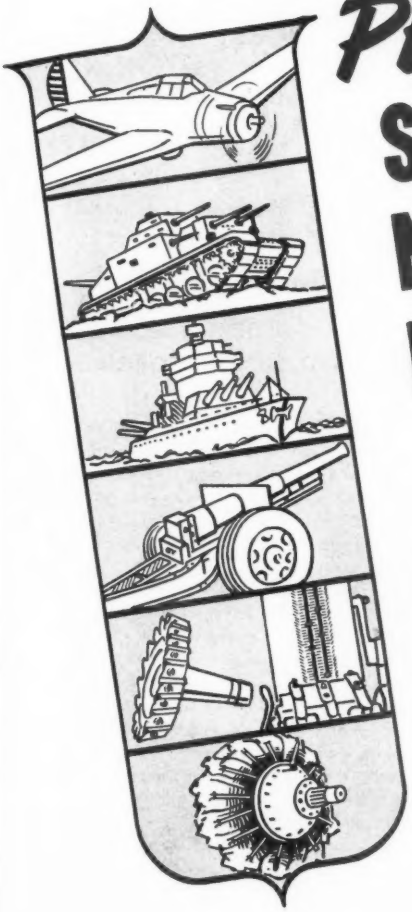

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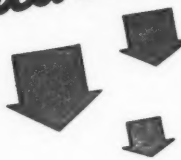
*fibro forged* SOCKET SCREWS

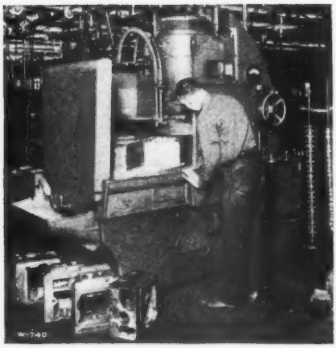
THE HOLO-KROME SCREW CORP. HARTFORD, CONN., U. S. A.

WRITE DEPT. 70
SOCKET SCREW STANDARDS

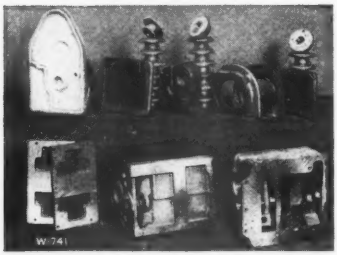
# *It takes the best to make the best!*



## THAT'S WHY LEADING MACHINE TOOL BUILDERS SPECIFY BLANCHARD SURFACE GRINDERS



No. 18 Blanchard Grinder



Group of parts ground on Blanchard Grinder shown above

YOU will find Blanchard Surface Grinders in all the leading machine tool shops. The reason? — It takes quality machine tools to reproduce quality in other machine tools. We illustrate a typical example of a Blanchard used on this type of work. 1/64" of stock is ground off two surfaces of the cast iron gear boxes, shown here, at a production of 15 pieces (30 surfaces) per hour. These boxes are 12"x12"x18". A Blanchard No. 18 Grinder with 36" chuck and a column extended to take 18" work is used, together with a Blanchard Sectored Wheel, manufactured by the Blanchard Machine Co. But that's only half the story. Formerly these gear boxes required hand scraping to obtain oil-tight joints — now they are ground on a Blanchard so that scraping is eliminated! In times like these, no one knows better the value of speed and quality than the machine tool industry. That's why old Blanchard customers are still Blanchard customers.

BLANCHARD

**THE BLANCHARD MACHINE CO.**
**64 STATE STREET, CAMBRIDGE, MASS.**

# Maximum Life from Every Cutting Tool is Essential Today

IN these days when cutting tools are not so easy to obtain, it is absolutely essential that each one deliver every possible minute of useful life. One of the best ways to assure maximum service is to resharpen each tool at appropriate intervals using the correct grinding wheel and the correct grinding method. Norton research has developed the correct wheels for every job and Norton engineering service is ready to show you the correct methods.

FOR SHARPENING HIGH SPEED STEEL TOOLS—fast cutting, cool cutting wheels of the special Norton "B-E" bond.

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Send for the booklet "NORTON GRINDING WHEELS for the Tool Room"—a condensed listing of the most popular sizes and shapes of tool room wheels.

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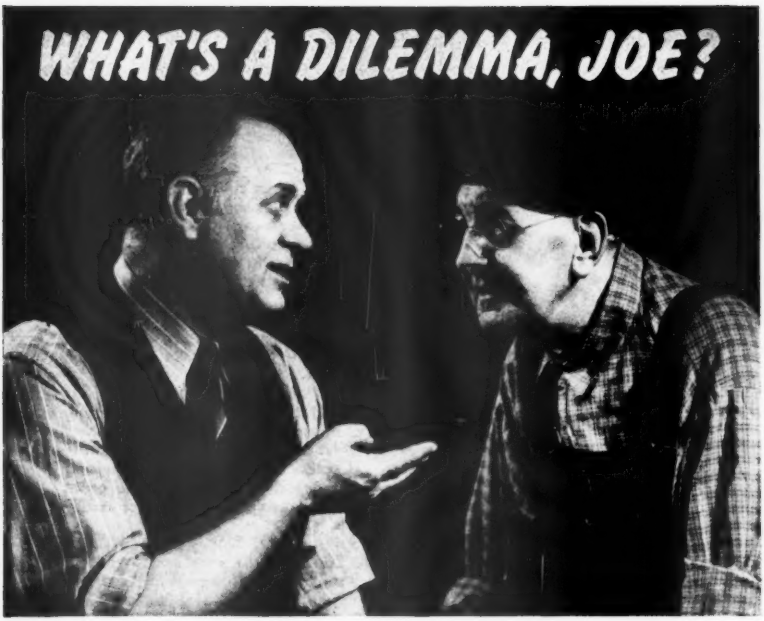


"Gosh, Bill, we've got one right here in the shop."

"How's that?"

"Well, here we are, chock-full of defense orders, and trying our darndest to squeeze in some files for our old-time customers. There's a dilemma for you."

"I'll bet we could make a lot more files if we cut a few corners."

"Sure we could, but the boss keeps saying, 'Only the best are good enough' and won't let us do anything else but make 'em that way."

"He's probably right at that. But with the war industries requiring so many of our files it leaves darn few for others to buy."

"Yes, it's a dilemma all right. I hope the folks that have to wait a few extra weeks for their files will realize we're doing the best we can and will be patient."

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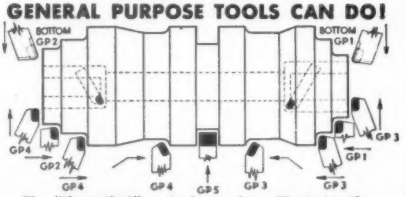
**SEE WHAT FIRTHITE GENERAL PURPOSE TOOLS CAN DO!**




**The "theoretical" part shown above illustrates the broad adaptability of FIRTHITE GENERAL PURPOSE TOOLS. It shows a few of the many jobs that these standardized tools can do faster, better and cheaper.**

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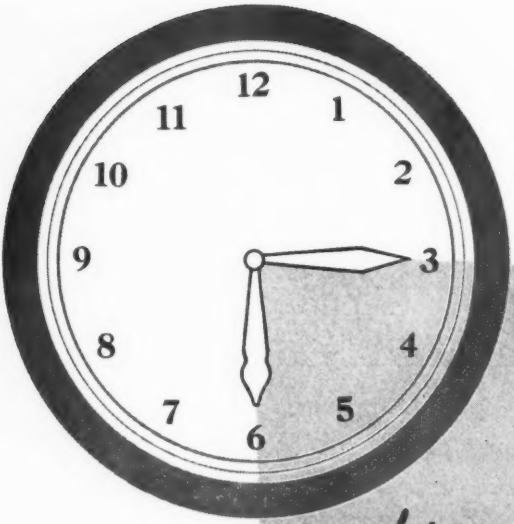


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Write for your copy of the Graphitic Booklet. It tells all about Graph-Mo, Graph-Tung, Graph-Sil, Graph-Al and Graph-M.N.S.

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**Steel and Tube Division**

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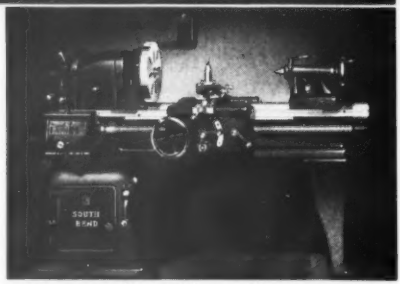

**When you deal with an authorized South Bend Lathe distributor these are the prices you are asked to pay—no more, no less. If any other dealer offers you a South Bend Lathe at a higher price for immediate delivery, it is not in accordance with any policy established by us. We will appreciate your reporting all such proposals to us for investigation.**

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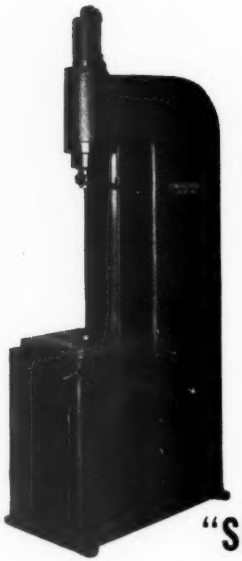

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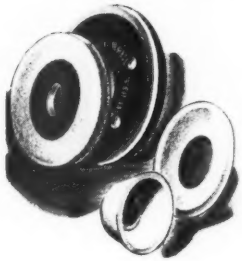

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Your die cost is lower when you specify HOVIS Screwlock Standardized Die Parts.

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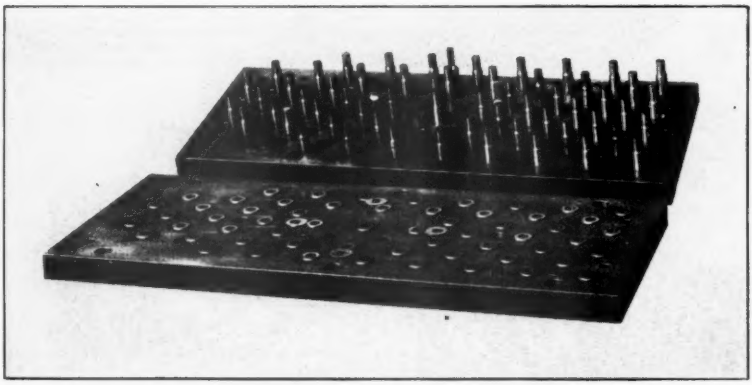

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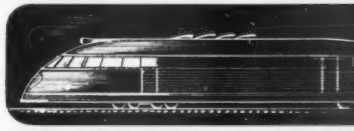

SURFACE FINISH

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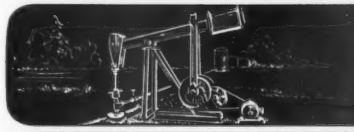

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# The VIKING TAPPER—
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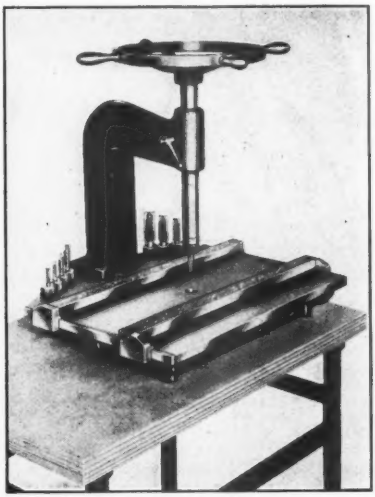

Base, semi-steel casting, well ribbed and seasoned to prevent warping.
Two sliding parallel bars to hold work in place while tapping.
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Spindle lock for holding spindle in position.
Two spindle bearing bushings hardened, ground and lapped.
Aluminum handwheel with four inserted steel handles.
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*pierces and rivets*

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# RIVITOR
(the new "RK" machine)

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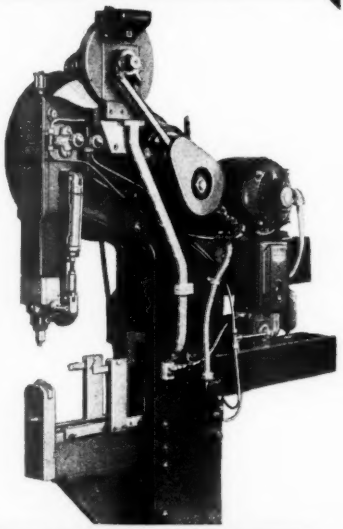

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THE TOMKINS-JOHNSON CO.
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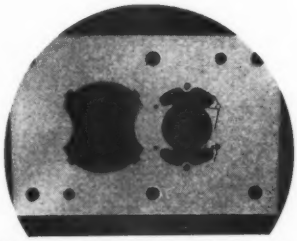
# "WE COULD HAVE MADE A NEW DIE, BUT . . . . :



Broken!! And A New Die Would Involve Delay and Cost $350.

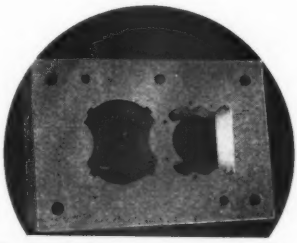
A new die would cost $350 and the cost in delayed production would be even more."

That is what confronted the Speedway Manufacturing Company of Chicago when a broken die tied up production.

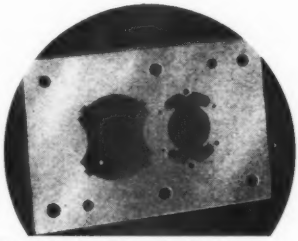
Their problem was solved by grinding away the damaged section with a Boyar-Schultz Profile Grinder No. 1 and fitting in an insert. The larger part of a new die cost was saved, in addition to the very important saving in time.

Boyar-Schultz Profile Grinders are made for grinding and fitting irregular shapes and contours so often encountered in making dies and punches, and in grinding to scribed lines. Work that would ordinarily take hours is completed in minutes.

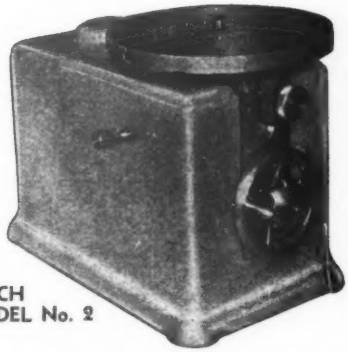
*Learn About This Time Saving Tool. Write For Literature.*



Damaged Section Removed and Die Prepared for Insert.



Fitted With Insert. Good As New and Ready to Go Back In Production With A Minimum of Lost Time.



BENCH MODEL No. 2

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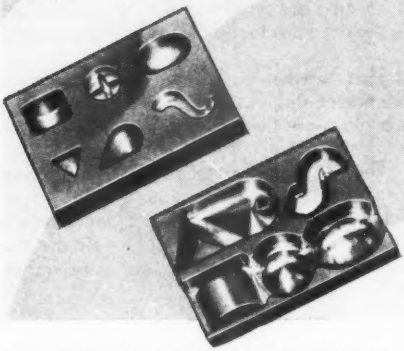


## . . . A TYPICAL EXAMPLE OF THE VERSATILITY AND SPEED OF THE MILWAUKEE ROTARY HEAD TOOL AND DIE MILLING MACHINE

The steel block, shown above, with its variety of geometric forms, was milled completely on both sides, without models or templates, in one setup on the Milwaukee Model D Rotary Head Tool and Die Milling Machine.

At no time during the entire milling process was the block moved from its original position in the milling machine vise.

This is another example of speed and versatility of a Milwaukee Model D—the machine that transmits blueprint into steel in a single setup—layout, milling, drilling, precision boring and slotting operations.

Investigate this machine and the new technique it offers for the production of dies and tools—in far less time, with positive accuracy, and at very low cost.

**KEARNEY & TRECKER CORPORATION**
MILWAUKEE WISCONSIN, U. S. A

*Milwaukee* MODEL D ROTARY HEAD TOOL AND DIE MILLING MACHINE

## *Milwaukee* MILLING MACHINES

The TOOL and DIE Journal

*TOOL–DIE–MACHINE* PROGRESS

SEPTEMBER, 1941 Vol. 7, No. 6

# *Designing Dies to Reduce Production Costs*

## Part II

By George Dannes

This is the second part of a two-part article begun in the August issue. The design and estimate of the first form and extrude die, the second die of the required set, is treated in this part. Again, as last month, the Die Work Estimating Sheet has been omitted. These sheets are available upon request. —*The Editor*

### Design

NEXT we proceed to the design of the first form and extrude die. This die has been designed as a "floating" die —making it possible for it to perform two individual operations with one stroke of the press.

First the blank is formed to shape, except for the flanges. After this forming has been completed, and only then, the holes are extruded. Strictly speaking, the holes are pre-extruded since the holes on one end of the part are to be tapped and reamed on the other end. The extrusion is performed by suspending the die proper, level with the gages, by means of air actuated pins. The pressure in the air cushion of the press must be regulated to give the best results for the stock thickness. In our case, considering the stock, a high pressure is necessary.

An examination of the cross section through the die and punch (Fig. 6) indicates that the die cycle is as follows:

Assume that the press is about to be tripped. The press ram is up. The die is also up or level with the gages and held firmly by the pressure applied by the air pins. The blank is placed between the two gages and the press is tripped. The punch pad, being held down by springs, is the first part of the punch to make contact with the blank. The pad holds the blank firmly to prevent it from shifting. The pilot, mounted in the pad engages through the hole in the blank into the clearance hole in the die before the pad actually makes contact with the blank, insuring that the position of the blank is correct before the pressure of the pad is applied to the blank. As the ram continues to descend, the pad, because the die is held in position by a stronger pressure than extruded by the pad springs, recedes into the punch. This permits the punch to contact the free ends of the blank, forcing the ends into the cavity of the die

until the form is completed.

At this stage of the cycle the pad reaches the end of its travel by striking the bottom of the punch holder. With the pad in this position the punch assembly can now be considered as a solid punch. As the ram still continues to descend, and as its force is much greater than the air pressure applied against the die, the ram carries the die down along the die guide blocks until the extruding punches have entered the holes in the blank. The die has now reached the limit of its travel and bottoms on the retainer plate. As the ram is just a trifle short from dead center on the crankshaft at this point, it is able to give the blank a tremendous wallop or spank. This serves to obtain a formed blank with flat straight surfaces, clean corners and nicely set extrusions.

The die follows the upstroke of the ram until the keeper stops further movement of the die. The pad moves out of the punch still holding pressure on the blank until it is carried free of the blank by the ram on its upstroke. The part is left deposited on the die where it is easily picked up and removed.

The thickness required on the punch holder is one obstacle to the use of a standard die set in building this die. To get maximum spring life a 3" travel of the pad is necessary and it is a well established principle that not more than 40 percent of the free length of a spring should be used for travel. The rest of the die is conventional except the pad, which in this case, is made in two pieces —a pad proper and a keeper plate backing the pad. The keeper plate serves as a backing for the pilot and provides more space for springs. The holes, which form the extrusions, and the pilot hole extend completely through the steels and shoes so that no dirt or other foreign matter has a chance to accumulate.

### Die and Punch Parts

The die consists of the following parts:
DIE—Det. 1
KEEPER BLOCKS—Det. 2—2 required
GUIDE BARS—Det. 3—2 required
GAGES—Det. 4—2 required
RETAINER PLATE—Det. 5
EXTRUDING PUNCHES—Det. 14—2 required
AIR PINS—Det. 15—4 required
DIE SHOE—Det. 16

The punch consists of the following parts:
PUNCHES—Dets. 6 and 7
PAD—Det. 8
KEEPER PLATE—Det. 9
PAD GUIDES—Det. 10—2 required
PILOT—Det. 11
SPRINGS—Det. 12—5 required
PUNCH HOLDER—Det. 13

There should be no difficulty in making this die.

Previous to layout of die, Det. 1, a selected piece of bar stock is squared and ground. After it has been determined from the second forming die and by trying out on flat stock how much stock is necessary for the developed blank, the approximate length of the die block plus the keeper on each side can be estimated. The contour of the blank can readily be machined. The gages can be set to compensate for any overall length of the die block. The location of the pilot hole and of the two extruding punches is taken direct from the print. These three holes are finished to size in one jig borer setup. The two keeper blocks, Det. 2, are made of tool steel and are hardened and ground to minimize wear. Besides squaring and grinding, the only other machine operation is milling of the keeper pockets and screw and dowel holes.

The two guide bars, Det. 3, are simply two blocks of squared, ground and hardened tool steel with the necessary screw and dowel holes. The gages, Det. 4, are made of water hardening steel and are mounted on top of the two keeper blocks.

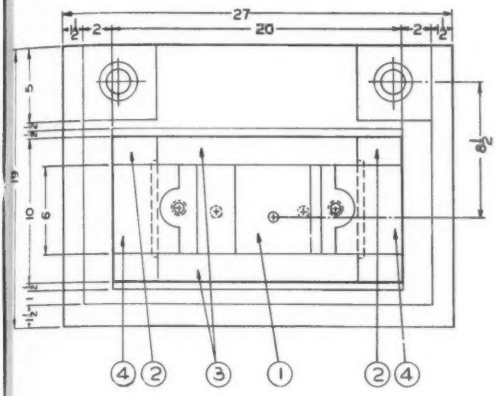
Location of the extruding punches requires another jig borer set-up. The whole die assembly, including the extruding punches, is mounted on the retainer plate. Frequently an alternate method is used which eliminates this second setup. This is to clamp the die securely to the retainer plate and jig bore both together.

Air pin holes and the clearance hole for the pilot, in both die shoe and retainer plate, are all drilled together in one set-up.

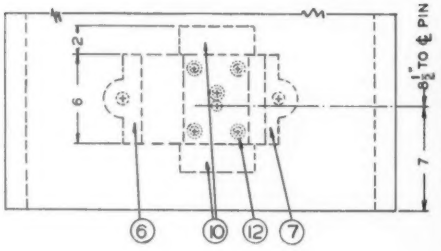
Assembling the lower portion of the die the procedure would be as follows:

Insert the extruding punches into the retainer plate, making sure that they are straight and square in all directions. Place the retainer plate on the die shoe

**Plan View of Die**



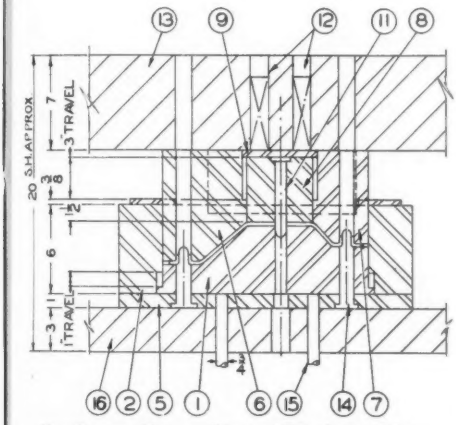

**Partial Plan View of Punch**




**MATERIAL LIST**

| Det. | Req. | SIZE & MATERIAL | Remarks |
|---|---|---|---|
| 1 | 1 | DIE 5″ x 6″ x 14″ | Bar Stock |
| 2 | 2 | KEEPER BLOCKS 3″ x 6″ x 10″ TS | Hdn. & Grd. |
| 3 | 2 | GUIDE BARS 2″ x 6″ x 13½″ TS | Hdn. & Grd. |
| 4 | 2 | GAGES ⅜″ x 5″ x 6″ | Water Hardening |
| 5 | 1 | RETAINER PLATE 1″ x 10″ x 20″ CRS | |
| 6-7 | 2 | PUNCHES 6-6″ x 6″ x 9″ 7-5″ x 6″ x 7″ | Hdn. & Grd. |
| 8 | 1 | PUNCH PAD 2½″ x 4½″ x 6″ TS | |
| 9 | 1 | KEEPER PLATE 1″ x 6″ x 23″ TS | |
| 10 | 2 | PAD GUIDES 2″ x 4″ x 5″ | |
| 11 | 1 | PILOT | |
| 12 | 5 | SPRINGS | |
| 13 | 1 | PUNCH HOLDER | |
| 14 | 2 | EXTRUDING PUNCHES | |
| 15 | 4 | AIR PINS ¾″ dia. x 4″ | |
| 16 | 1 | DIE SHOE | |

**First Form and Extrude Die Designed by George Dannes**




**Section on Center Line of Die Assembly**

and clamp securely in position. Then fit the die over the extruding punches and the punch guide holes which are lapped if necessary, until a good slip fit is obtained. Next the two keeper blocks and the two guide blocks are clamped in place. The whole assembly then can be drilled for screws and reamed for dowels in one set-up. After disassembling, the die shoe is tapped, and keeper and guide blocks redrilled and counterbored for screws. Reassembling and doweling should finish the lower die.

The punches, Dets. 6 and 7, are also machined, hardened and ground to print dimensions, considering, of course, the stock thickness between the punches and the die. Except for shaping the outer ends to clear the gages and the working end of the piece part contour, everything else is square work. Each punch has a recess milled on the inside where the pad travels to act as a keeper for the pad. The pad, Det. 8, is a square piece of tool steel machined accurately to dimensions for a slip fit between the two punches. A tool steel plate is screwed on the top side of the pad to act as the keeper and also to back up the pilot. Pad guides, Det. 10, serve to keep the pad from sideward motion. Then the punches and pad are clamped together

*(Continued on Page 42)*

# HONING:

# Economical Stock Removal plus Surface Finish

## Part II

*By Lysle L. Hazen, Engineer*

*Enterprise Machine Parts Corporation*

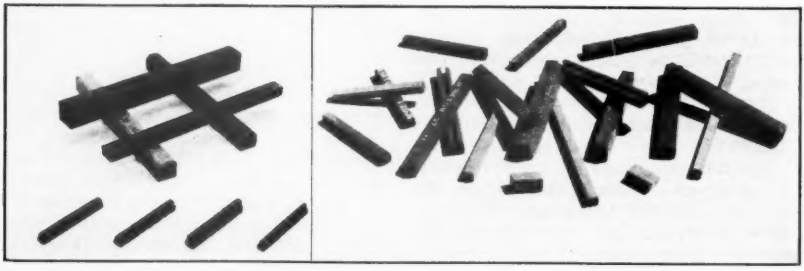
HONING sticks or stones, as they are designated, are made by bonding suitable abrasives to a desired shape, generally rectangular, thus enabling them to be held in an adjustable tool holder. The latter may be of several types, of which three have proven particularly effective; the automatic, mechanically actuated type; the semi-automatic mechanically actuated type; and the hydraulically operated type. Usually all have interchangeable units which provide the necessary size ranges.

The number of honing sticks required in a tool varies as do also their widths, lengths and thicknesses. These interchangeable units or sticks are made of different grades of bonded abrasives to make the honing tool either a rugged stock remover, or to enable it to operate under such sensitive control that a near-perfect surface finish can be attained. All honing tools, even though developed for heavy-duty applications and used effectively for stock removing, nevertheless can produce a surface finish with a high degree of smoothness.

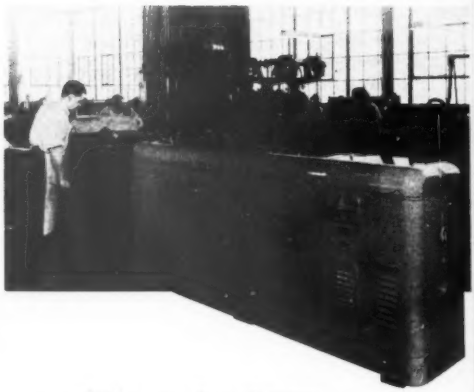
Uniformly controlled cutting action is obtained in the honing process by achieving a multi-directional travel path of the honing sticks in various combinations of rotation and reciprocation. In most cases the piece to be honed is clamped in a stationary position and the modern types of honing machines cause the honing tool to travel in the axis of the bore and rotate and reciprocate at an effective speed. The work-piece may also be rotated or reciprocated or both, in addition to the movement of the honing tool.

### Wide Range of Speeds

Honing speeds may vary from 30 to 300 feet per minute, depending upon the amount of stock to be removed and the surface finish required. These requirements, in combination with the type of the material—ferrous or non-ferrous materials, hard or soft alloys—and the grade of abrasive sticks will necessarily govern the speed to be used. A rule-of-thumb computation which may be used for estimating operating speed for stock removal is to set the controls for a rate of .001 of an inch per square foot



**Typical honing sticks or stones. Note variety of shapes, sizes and lengths. Photo right, Courtesy Norton Co; left, Carborundum Co.**



**A modern horizontal type, mechanically actuated honing machine. Photo Courtesy Enterprise Machine Parts Corporation**

of surface per minute of actual operating time.

Complete honing equipment includes the tool actuating mechanism, a suitable work holding fixture and a tool correctly correlated to remove stock and generate surface finishes in bores and on outside surfaces. Several developments have to date been found efficient. At the present time, they are basically the controlled mechanical application of bonded abrasives on the internal surfaces of cylindrical bores and on the external surfaces of cylindrical contours.

The modern honing machine contributes toward control of surface generation by correct actuation of the tool in motion by the effectiveness of its driving mechanism. There are several ways of reducing the penetration of the grits to accomplish this. One method is to reduce the pressure of the abrasives on the work and depend upon the viscosity of the coolant or lubricant to support them in a "sparking out" action. Another method maintains the pressure while increasing the speed sufficiently to prevent penetration of the grits in the metal.

Because the generation of accuracy for roundness and straightness is the primary accomplishment of good honing, a perfect mechanical balance in tool design and tool actuation is absolutely essential. A well balanced tool should permit the arrangement of honing sticks in such a manner that there is uniform pressure distribution while the tool, actuated by the controlled mechanism at all times, centers itself in the hole.

### Methods for Generating Accuracy

The methods for generating accuracy for roundness, diametrical straightness and axial straightness has been briefly set forth as follows:[1]

a. Attain accuracy of roundness by rotary motion of the honing tool, the expansion of which should be positively controlled within itself. It is highly important that the tool be actuated by a machine which provides a perfectly even flow of power.

b. Attain accuracy for diametric straightness by a perfectly controlled stroke which permits uniform "reversing traverse" by the honing tool, thus correcting errors of taper.

c. Attain accuracy for axial straightness by the use of stones sufficiently long to overcome any uneveness of surface which may have been caused by heat treatment or which earlier machining operations may have developed in the bore.

### Two Kinds of Surface Finish

Two kinds of surface finish, both of very smooth character, can be obtained with a scientifically designed honing machine and equipment. The first is the result of a simple rotation combined with a simultaneous reversing stroke of the honing tool, giving it a multi-directional travel path. This is used in conventional applications. The second surface finish is the result of a simple reversing stroke with a degree plus (°+) of rotation at the end of the traversing stroke, giving it a co-directional travel path. This co-directional honing is merely the establishment of a straight line travel path rather than one of spiral form.

The character of a surface finish may be observed for pattern by microphotography, or it may be measured by the Profilometer, which makes "records of magnification of the order of 50,000 at which magnification 'a micro-inch is nearly $\frac{1}{8}$ of an inch on the record and a human hair would be about 15 feet across'."

*(Continued on Page 44)*

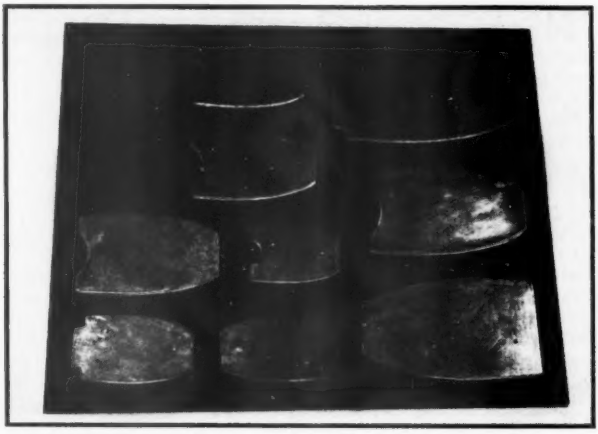
[1]K. W. Connor: "Honing—A Symposium on Mechanical Surface Finish."

# Masonite Die Stock Speeds Production— Lowers Die Cost

THE airplane industry is engaged in a titantic program to achieve in two and a half years industrial manufacturing plants comparable to those which took the automobile industry thirty years. Under such pressure new methods and materials, new processes and techniques must bear the brunt of speeding up production without loss of precision, and if possible, at a lower cost.

One of the bottlenecks with which the skyrocketing plane building industry was threatened, was in the methods of cutting, forming, and processing of large quantities of thin sheet metals, as practically the entire plane, fuselage, wing and tail assemblies, etc., are constructed of comparatively thin sheet metal of different alloys. To develop the maximum strength and stiffness beads, flanges, and curved surfaces were necessary. In the processing of the thin metal sheets each model plane would require hundreds of templates of various sizes and shapes for cutting the metal to proper contour, and hundreds of dies of different types for deforming and shaping the metal, all calling for exact precision work. In addition to the templates and dies, drill jigs and assembly fixtures of all kinds and shapes are necessary to assemble these thin formed pieces of sheet metal into a finished airplane. The time and cost factors to design and build such a set of dies is a tremendous undertaking.

One of the answers to this problem is Masonite Die Stock. This light, durable and easily worked material has proven very successful as a die material.

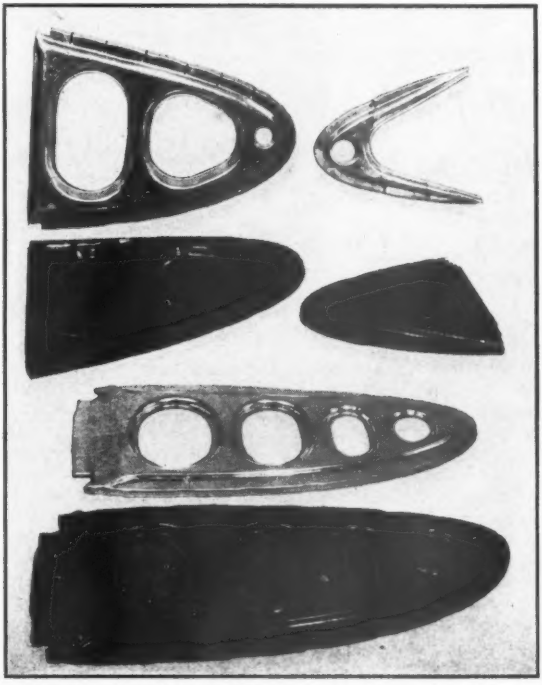


**These Shearing Dies are made of Masonite Die Stock faced with $\frac{1}{16}$" Chrome-Molybdenum Steel.**

The dies manufactured from this material may be produced in a fraction of the time and cost of dies made from metal or other materials. This is due to lower initial cost of material, and to the speed with which this material may be cut and machined, as all types of high speed woodworking machines and equipment may be utilized in this processing,

thus freeing the metal working machines for other urgent jobs.

Masonite Die Stock is particularly adaptable for dies used with the Guerin Process. This process (see article "The Utilization of Rubber in the Fabrication of Plane Stampings", June 1939) now



**Draw Dies for aircraft wing ribs and parts formed. This type of work is very successfully done by the Guerin Process, using hydraulic presses.**

licensed in a number of plane factories, as well as in plants making a wide variety of formed articles from thin sheet metal, utilizes restrained rubber press pads as the punch or opposing surface of dies made of Masonite Die Stock.

This process is used for shearing, forming, combination of shearing and forming at one time, embossing, and other operations. While this process was designed essentially for hydraulic presses, it is also adaptable to toggle and other types of presses. The technique eliminates the need for mating dies, as the rubber acts as the punch or opposing surface of whatever die element is required.

Masonite Die Stock combines light weight, high compressive and tensile strength, with durability and toughness. Steel or other metals will weigh approximately six times the weight of Masonite Die Stock for the same thickness of material. Because of this light weight, the dies required for an entire assembly may be grouped and attached to a large panel of Die Stock, permitting group shearing or forming at one time. The Die Stock has the added advantage that it will not score or scratch the metal, and has a natural lubricating effect which allows forming with rubber without the use of any lubricant or drawing compound.

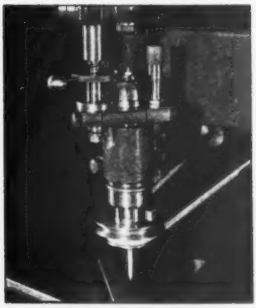
Masonite Die Stock dies are so inexpensive that they are economical for

*(Continued on Page 40)*

# *Gorton Munitions Engraver Speeds Defense Production*

AS another contribution to Defense, the George Gorton Machine Co., Racine, Wis., announce that the new stripped down engraving machine, the Model M-E Munitions Engraver, is now in production. Designed especially for rapid repetitive work in Defense plants, particularly for aircraft, ship and gun fire control instruments, the M-E Engraver is being manufactured for earlier delivery three times as fast as the standard engravers now on the OPM Critical List of tool shortages. The new machine does small, accurate engraving and profiling—it is a precision tool sensitive enough for wax engraving on glass, yet rigid enough for cutting in steel.

Commenting on the importance of bringing out a new model at this time, George Gorton, III, Vice President of the company said: "Two years ago we anticipated the urgent need for more production-type Engraving Machines. To get months faster delivery and meet the demand for machines for the job, we undertook the design of a simplified model that could be quality-built more quickly, would require little set-up time and be easy to operate with only the essential features ideal for long production runs. The result is the M-E Munitions Engraver, a 'special-purpose' production machine."



**Top — An engraving job in process.**

**Left — The simplified design cutter spindle.**

By eliminating many of the controls and adjustments which make the standard machines so versatile for general purpose work, without lowering the quality, many important time and labor savings have been achieved in its manufacture, making possible speedier delivery at a substantially lower price. The three most important construction features are: a simplified spindle drive, the semi-fixed table with vertical movement only, and a fixed ratio pantograph.

The simplified spindle drive eliminates the manufacture and fitting of a motor bracket and stud and the boring and tapping of a hole in a machine column for fitting the stud. Considerable time has been saved in fitting and testing idlers, formerly necessary to provide vibration-free power to the spindle. This new de-

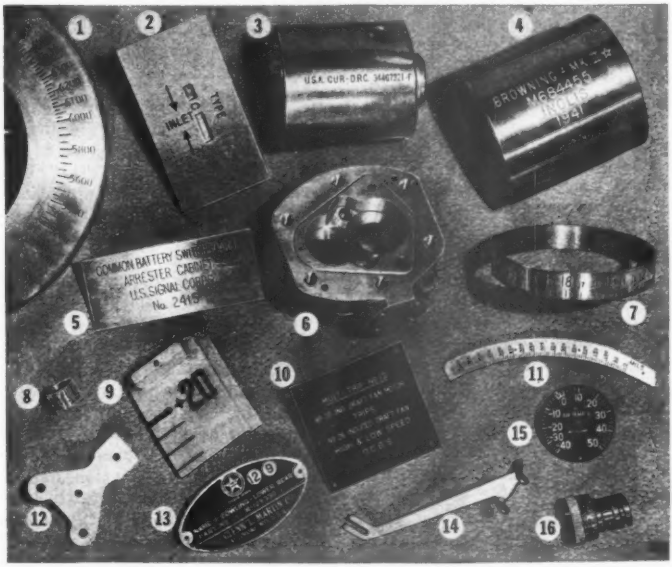
sign has proven so satisfactory that it is to be adapted to future models of the standard engravers. The M-E simplified cutter spindle is a precision unit of simple, sturdy construction, entirely self-contained and can be detached for grinding cutters in place. A $\frac{1}{10}$" micrometer feed adjustment is graduated in thousandths. A flat work Cutter Head is supplied as standard equipment but a double-purpose Cutter Head to do both curved work and flat work is available at slight additional cost.

The new semi-fixed table assembly also saves time and material. By furnishing the table with only a vertical movement, two feed screws and graduated hand wheels are eliminated. This table also does away with the need for hand scraping the horizontal and compound slides and bearings.

Perhaps the greatest time saver, from both the production and assembly viewpoints, was the adoption of a fixed ratio pantograph. This alone saves several hours since on the M-E it is unnecessary to calibrate the pantograph bars to insure accurate settings throughout the entire reduction range. This accuracy is now assured through finish reaming the pantograph bar holes in precision fixtures. Standard fixed reduction ratio of either 3:1 or 6:1 can be specified. More than one size of a given part can be reproduced simply by changing the size of the master or model.

Another advantage is that stock tools and accessories used with the standard engravers are *interchangeable* for use with the M-E so that, except for work holding fixtures, it is not necessary to

*(Continued on Page 42)*




**Munitions parts illustrating range of engraving, milling and profiling on steel, brass, nickel silver, aluminum and plastics parts. 1. Gun Range Scale, engraved, 45 min.; 2. Indicator Plate engraved and slots milled, 4 min.; 3. Airplane Radio Field Case, engraved, 2 min.; 4. Gun Barrel, engraved, 5 min.; 5. Switchboard Plate, engraved, 3 min.; 6. Plane Propeller Pump Housing, packing groove milled, 2 min.; 7. Range Finder Band, engraved, 15 min.; 8. Gun Sight Dial, engraved, 2 min.; 9. Graduated Section, engraved, (plastics) 1½ min.; 10. Multi-Trip Nameplate, engraved, (plastics) 6 min.; 11. Gun Elevation Scale, engraved, 6 min.; 12. Side Plate Support, engraved, 5 min.; 13. Martin Bomber Plate, engraved, (Figs. 9 and 12) 15 sec.; 14. Indexing Lever, profiled, 10 min.; 15. Air Temp Dial, engraved, 15 min.; 16. Graduated Dial Screw, engraved, 20 min.**

# What is back of Good Tool Steel?

**A. F. Dohn, Vice President**
**Allegheny Ludlum Steel Corp.**

"GOOD Tool Steel" is a much more comprehensive term than it used to be. What is the reason for this? It is explained chiefly by the fact that Tool Steel quality today is maintained at much higher standards than twenty-five years ago. This has been brought about by constantly improving mill practice resulting from better control of melting and heating operations, advances in our knowledge of metallurgy, and the requirements of Modern Industry.

Present methods of mill inspection have advanced materially from the old days when surface inspection and examination of the topped or fractured ends for pipe, grain size, and bark was about the limit of what was done. In the days of crucible melting, carbon content was estimated by appearance of the fracture.

This is in marked contrast to what must be done today. Industrial progress is reflected in much higher standards of quality. Careful control of all production operations is now necessary if rejection of the finished product is to be held to a minimum. Of course, inspection of surface and fractured bar ends is now made as in the past. But in addition, numerous other tests are made to check up, for example, on the uniformity or completeness of the annealing and hardness limits set up for the various grades.

Laboratory tests are now common that were unheard of not many years ago. The science of metallography has progressed to such an extent that the microscope is indispensable for checking up on structure, and microexamination is routine on many orders. This inspection is carried out on representative samples examined for inclusions, degree of spheroidization of carbides, carbide segregation, or in the case of highly alloyed steels, carbide distribution.

Some tool manufacturers insist on very low decarburization limits, and it is necsary to check up on such orders microscopically, extending the tests to individual bars or coils.

The deep etch test, while not new, has come into more and more use as a method of inspection for internal defects. This method of testing is especially valuable for checking up on the center condition of bars going into dies where the center is subject to great stress or wear as for cold header dies, drawing, or embossing dies.

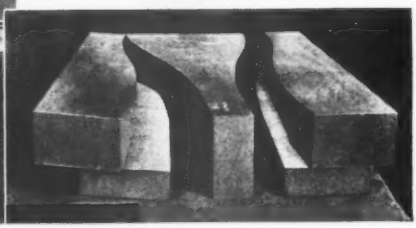
### Steel Cost Insignificant

When one considers the insignificant cost of the steel as compared to the labor on the average tool or die, the expense of this kind of inspection appears little. On the other hand, the application of this testing to hundreds of bars in the course of a month represents quite an item of cost and illustrates one phase of the mill's efforts to satisfy the customer.

Hardenability is another quality of tool steel that has been receiving more attention than in the past. A better knowledge of this property as applied to carbon tool steels has resulted in the production of steels with wide hardening range and uniformity of hardness penetration. Examination of hardened fractures is another useful test, particularly with the more highly alloyed tool steels that harden deeply.

As a result of modern manufacturing and inspection methods, tool steel customers are getting better results than ever before from the tool steel they purchase. This results, first, from better heat treating equipment and methods; second, closer relations between mill and user and better understanding of tool steel problems; and finally, from greater effort on the part of the mill to maintain high standards of quality.

# METAL SAWING IS DUCK SOUP FOR THE DoAll



On the DoAll, the Hawthorne Metal Products Co., Detroit, Mich., cut the five sections of a die from one block of boiler plate steel 5" thick, 16" long, 14" wide—only 4 cuts of the saw necessary. Time—1¾ hours for each cut, or at the rate of ¼" per minute. Saw used—½" 6 R.H. Speed—150 f.p.m.

## GREATEST TIME SAVER EVER—

**The DoAll is the machine tool that is effecting unprecedented savings wherever installed, in machine shops, tool rooms, automobile and truck factories, railroad and aeroplane plants, arsenals and shipyards, etc.**

**The DoAll is an all-purpose machine—does internal and external band filing, sawing and polishing on any kind of metal or alloy. Handles work at various angles.**

**Let us send a factory trained man to your plant with a DoAll to show you how a DoAll will handle your cutting jobs.**

**FREE—Literature and 158-page Handbook on Contour Machining.**

## CONTINENTAL MACHINES, INC.

1303 S. Washington Ave. Minneapolis, Minn.

**Associated with the DoAll Company, Des Plaines, Ill., Manufacturers of Band Saws and Band Files for DoAll Contour Machines.**

DO-ALL Contour Machine BAND SAWING BAND FILING BAND POLISHING

# *The Honing Process and the Application of Honing Tools to Defense Work*

By Lawrence S. Martz

Micromatic Hone Corporation

THE use of honing sticks or stones permits the mechanical application of bonded abrasive in large area contact with the work. A multitude of bonded abrasive grains (or "cutter tips") are in *simultaneous* contact with the work. Uniformly controlled cutting depth of the bonded grains is obtained by a multi-directional travel path of the sticks, in various combinations of rotations and traverses, or reciprocations. Where desirable, the work may also be rotated or reciprocated, or both, in addition to the actuation of the honing tool. These combined motions serve to provide a universal force actuation on all individual grits, regardless of the angle of their cleavage planes to the work, and on all bond posts, thus accomplishing a uniform rate of fracture of the grits.

The simplest form of multi-directional actuation in conventional applications is shown in Fig. 1. The action consists of a simple rotation with a simultaneous reversing stroke or traverse of the tool. The combination causes the abrasive stone or stick to generate a simple harmonic abrasive path—the path of a wide angled helix of steep pitch. The ratio of revolutions to reciprocations is from 3½ or 4 to 1. As illustrated, for simplicity the ratio is slightly more than 2 to 1. The stick does not return to its original starting position, but successively overlaps its previous position at the end of each stroke. The crossing of these paths on the forward and reverse strokes produces the "cross-hatch" character of cutting marks.

The essential value of odd-ratio combinations of motion is illustrated in Fig. 2. The upper part of the graph shows a typical coverage of work surface by a single grit in honing. The lines follow the path of one rotational and two reciprocational motions working simultaneously. The combinations of odd-ratio movements possible are practically infinite. Such combinations can be arranged for any degree or type of finish required. This type of actuation is important in producing more rapid stock removal, longer stone life and planar surface accuracy. The lower part of the graph shows the typical path of a single grit under unit or evenly divisible ratio of mechanical motions. This grit path will repeat itself indefinitely.

Pressure application in honing is controlled either mechanically or hydraulically and is entirely controlled by the tool adjustment mechanism. Mechanical control is either by hand brake or automatic type tools. In the first, the correct pressure cycle—low starting pressure, increasing to higher pressure and tapering off to runout pressure—is possible, but is entirely dependent on the skill of the operator. In automatic tools, a caged spring is employed to provide consistent control of pressure. This gives more uniform production as far as accuracy and finish are concerned. As the spring elongates, the work unit pressure is decreased, making such a tool satisfactory for finish honing where diminishing pressure is advantageous. However, the elongation of the spring limits economical stock removal.

Hydraulically-controlled pressure per-

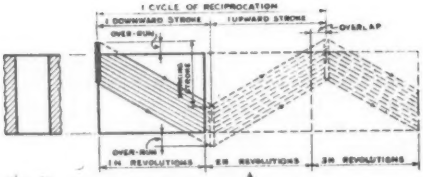
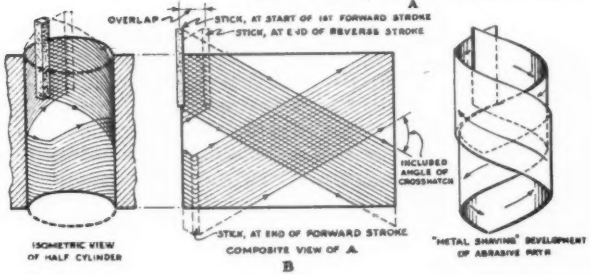



Fig. 1—Right

Fig. 2—Below


OVERLAP
STICK, AT START OF 1ST FORWARD STROKE
STICK, AT END OF REVERSE STROKE
INCLUDED ANGLE OF CROSSHATCH
STICK, AT END OF FORWARD STROKE
ISOMETRIC VIEW OF HALF CYLINDER
COMPOSITE VIEW OF A
"METAL SHAVING" DEVELOPMENT OF ABRASIVE PATH
B

mits unlimited combinations of pressure adjustment during the operating cycle. The most accurate control of pressure to fit the most efficient conditions for stock removal or the exact degree of control to create the specified final surface smoothness is practical. Hydraulic pressure control is the greatest single advancement in the honing process since the development of automatic type tools.

Microfinish* honing, comprising methods of processing developed by the Micromatic Hone Corporation of Detroit, and as the final processing applied to bores and some external cylindrical surfaces, of many parts, produces the following combined results:

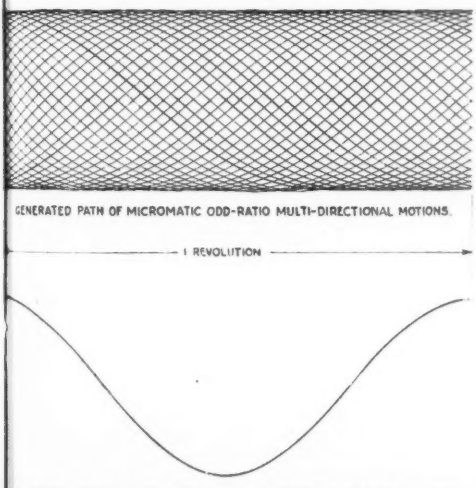
1—Corrects errors resulting from previous processing operation and generates final geometrical accuracy within extremely low tolerance, uniformly in high production. In honing, a bore which is undersize, or which requires additional, correctional processing, may be re-chucked and finished to specified tolerances. This is a uniquely important feature in the field of generative mechanical processing.

2—Generates final diameter size, uniformly within low tolerance.

3—Generates productively any desired type of surface finish characteristics of maximum surface quality.

4—Provides control in one process of rapid and economical stock removal consistent with accomplishment of the above mentioned results, in a minimum amount of time and number of operations.

Developed nearly ten years ago for finishing bores of automotive cylinders, it is now widely employed by aircraft and other engine manufac-

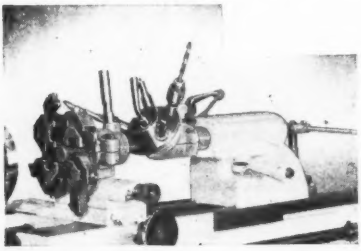

GENERATED PATH OF MICROMATIC ODD-RATIO MULTI-DIRECTIONAL MOTIONS.
1 REVOLUTION
GENERATED PATH OF EVEN-RATIO SINGLE-DIRECTIONAL MOTION -- BOTH GRAPHS REPRESENT THE PATH OF A SINGLE ABRASIVE GRAIN

*Reg. U.S. Pat. Office

*(Continued on Page 46)*

## *Five Tool Turret Steps Up Engine Lathe Production*

A NEW five tool rotary turret head designed to increase production on engine lathes has been placed on the market by the Jefferson Machine Tool Co., Cincinnati, O. The attachment may be installed in a few seconds to the tail-stock spindle of any engine lathe. It is



bored to a micrometer fit to the outside diameter of the spindle on which it is to be used. The turret permits the operations of forming, roughing, boring, finishing, drilling, tapping, etc., without stopping to change tools during five different operations. The unit may be used on more than one lathe by using a stud arbor with a Morse taper to fit the tapered hole in the tail-stock spindle. The turret is available in four sizes for use on machines ranging from small bench lathes to large lathes having tail-stock spindles up to 3¼". The illustration shows the five tool turret head in the center.

A second attachment shown at the left in the illustration and used in conjunction with the tail-stock turret is a four tool-post unit which may be mounted on the cross slide or the compound rest of the tool-post carriage. The head holds four standard make tool-holders which may be adjusted to any desired pitch or height in relation to the lathe center. This unit is available in two sizes and may be used on more than one lathe.

A third attachment for converting a standard engine lathe into a production turret lathe is the Jefferson adjustable pull-feed. This is designed to eliminate the slow movement of the tail-stock spindle by the usual hand wheel method. It can be used on lathes having a swing of 18" or less.

With these three attachments a standard engine lathe can be utilized to do precision turret lathe operations.

**These units are manufactured by the Jefferson Machine Tool Co., 710 N. W. Fourth St., Cincinnati, O. An illustrated circular will be sent on request.**

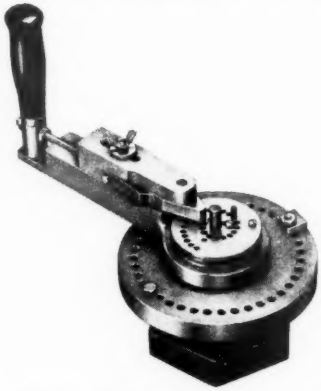
---

## *New Features Added To Die Duplicating Bender*

TWICE its former working capacity is now possible with the improved Micro Die Duplicating Bender No. 1, manufactured by O'Neil-Irwin Mfg. Co., Minneapolis, Minn. The unit's new two-way operation eliminates interference of material ends with work already formed, particularly in many kinds of intricate and symmetrical shapes on opposite sides of a center point.

A positive adjustable stop holds the forming nose rigidly in position when shaping heavy materials. Additional provisions for material guides are another added feature. While the weight of the unit has been increased only three pounds, the bearing capacity has been increased two and a half times, assuring long life and permanent accuracy.

The improved Micro Bender No. 1 as-



sures greater ease of operation and increased hourly output and stability.

**Specifications, operating data and detailed construction features of the improved Micro Bender No. 1 are available on request made to O'Neil-Irwin Mfg. Co., 315 Eighth Ave., S., Minneapolis, Minn.**

# The Modern Mach
# Microfinis

*The hydraulic cylinder on the EMPCO is 84" long and 8.625 ID. Using 220 K stones and a spindle speed of 133 RPM, stock was removed at approximately .001 per surface foot per minute. The material is MS tubing, total stock removal .025.*

**The EMPCO is a conventional and c**

**The cylinder is recip**

**Spindle speeds — 3! with the working st**

**Stock is removed at sary, as well as proc**

***Write for your copy of New Honing Bulletin.***

**ENTERPRISE MACHINE**
**2731 JEROME AVENUE — — —**

# Machine for
# cofinish Honi

e EMPCO is a horizontal, mechanical
nventional and co-directional honing.

e cylinder is reciprocated automatically

indle speeds — 35 to 250 RPM in eight
th the working stroke generating a multi

ock is removed at a rate which, in most
ry, as well as producing the desired degr

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**MACHINE PARTS COR**
DETROIT, M

# *or Precision ning*

anical machine, providing for both ng.

cally or manually.

eight increments — are synchronized multi-directional abrasive travel path.

most cases, makes grinding unneces- degree of surface smoothness.

## *The Modern Machine for the Modern Shop*

- Economical stock removal to Precision limits.
- Generates Dimensional Accuracy through full length of bores.
- Corrects for Diametric and Axial Straightness.
- Corrects Errors in Diametric Roundness.
- Versatile and Efficient in Operation.
- Modern, Streamline Design.
- Rugged Construction.
- Simple, long life, trouble-free Operation.

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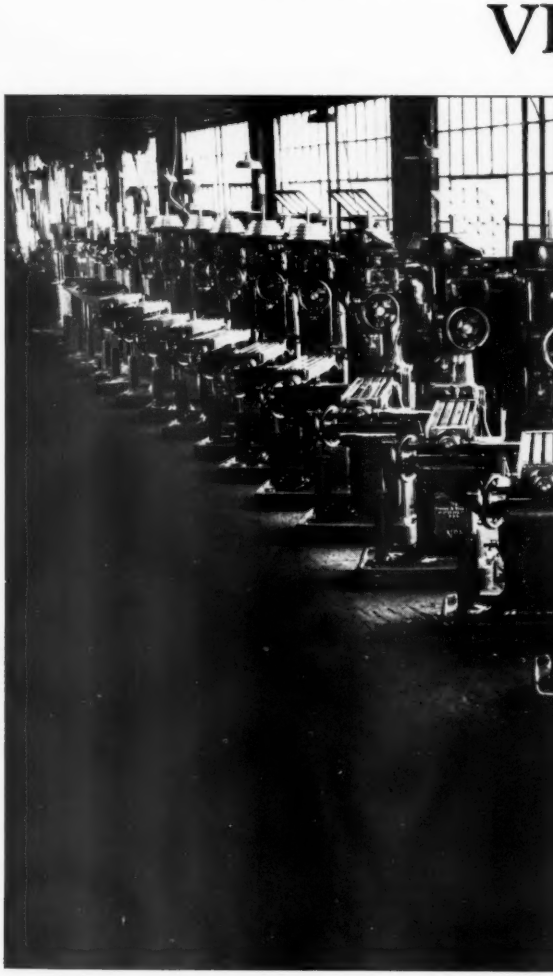
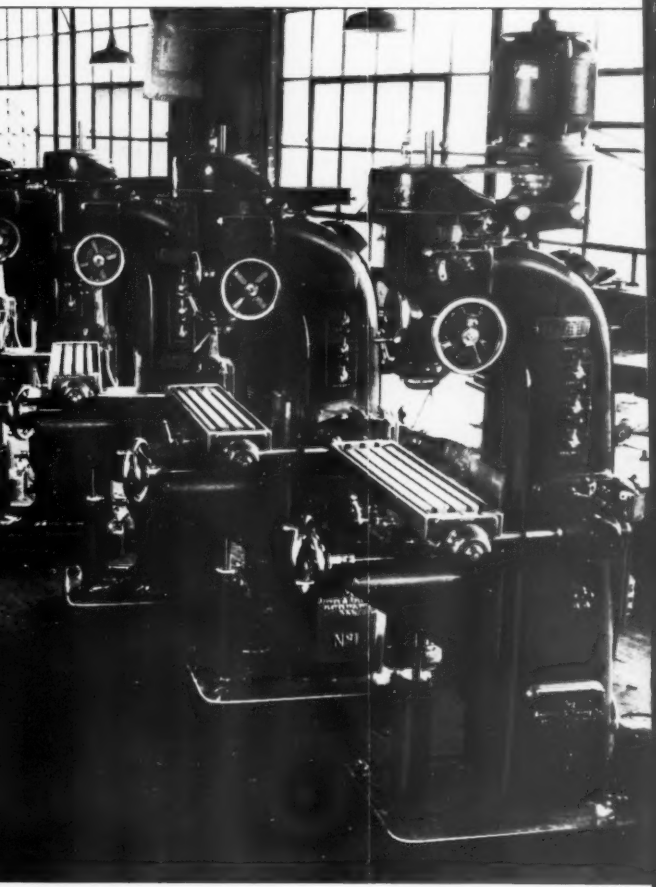


THE SOMME
18511 EUCLID AVENUE

# AND NO. 1
# VERTICAL MILLIN



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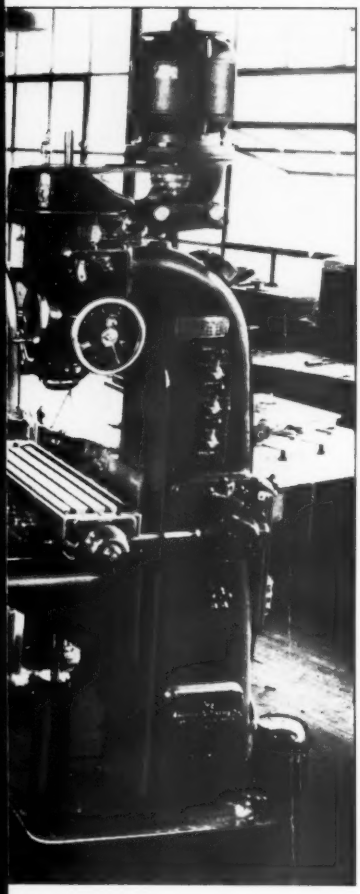
# L MILLING MACHINE



is proving its value in modern tool rooms, die and mold shops where exacting, heavy demands must be met. It is equally efficient in continuous precision manufacturing.

The Cleveland No. 1 Vertical Milling Machine is now in volume production to meet insistent demands of the Defense Program.

## SPECIFICATIONS

**Capacity:**
Longitudinal feed, 18″
Cross feed, 8″
Vertical feed, 16″

**Table:**
Working surface, 8″ x 32″
T-Slots, Three, 17/32″
Power by 1/3 hp motor

**Table Feed:**
Twelve feeds with range from .6″ to 12½″ per minute.

**Spindle:**
Chrome nickel steel, heat treated and ground.
Taper No. 30 (new National Standard)
Mounted on Pre-Loaded Precision Ball Bearings.

**Spindle Speeds:**
Twelve, with range from 100 to 1850 rpm. Power from 1½ hp motor, flange mounted and adjustable with hand wheel to shift "V" belt for quick change of spindle speeds.

**Feed Screws:**
Mounted on Timken bearings; are provided with dials graduated in thousandths of an inch.

**Feed Gears:**
Chrome nickel steel; mounted on Timken bearings.

**Floor Space:**
36″ x 42″ front to back and 87″ high.

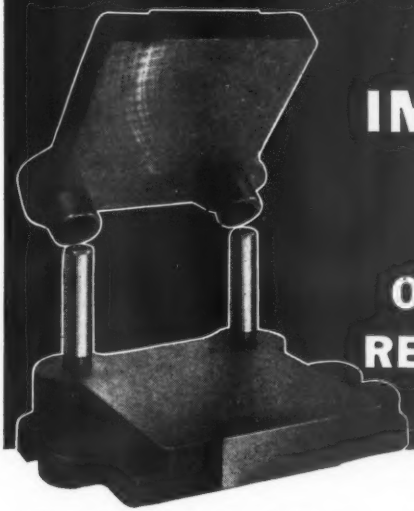
**Cutter Capacity:**
1/16″ to 2½″ mills.

**Also High Speed Operation:**
Design and construction of the Cleveland No. 1 Miller permit 8 operating speed changes ranging from 900 to 6000 rpm when equipped with 2-speed motor with speeds of 1800 to 3600 rpm.

**AMS CO.**
**CLEVELAND, OHIO**

*Descriptive Circular Sent Promptly on Request.*

# The Interchangeability of DANLY DIE SETS IS IMPORTANT TO YOU *In the* OCCASIONAL REPLACEMENT OF A PART



*It Is Far More Important As a Continuous Guarantee of Accuracy in Die Making and Daily Production of Stampings*

WRITE OR CALL YOUR DANLY BRANCH

**DANLY MACHINE SPECIALTIES, INC.**
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Ducommun Metals & Supply Company, Los Angeles, California; San Francisco, California

**DANLY DIE SETS and DIE MAKERS' SUPPLIES**

## Masonite Die Stock Speeds Production — Lowers Die Cost

*(Continued from Page 27)*

short run work as well as for the longer run production jobs. In fact, on very high production work the cost of duplicating the dies to complete the run is still considerably less expensive than a single set of steel dies. This advantage grows in importance as the demand on the available supply of die steels continually mounts.

While the aircraft industry was the first to use Masonite Die Stock extensively, the Die Stock because of its versatility in forming thin gages of sheet metals, such as body and stainless steel, magnesium or aluminum alloys, is employed in many industries for many types of dies. For example, Masonite Die Stock is being used quite extensively faced with a thin gage of metal, such as $\frac{1}{16}$" chrome molybdenum steel for all types of shearing and punching dies. In this use the die stock acts as the body, the stiffening portion, the thin gage metal facing, doing the actual cutting or shearing. This materially reduces the time required to produce the die and the cost of materials is considerably less than similar dies made of steel.

Masonite Die Stock is also used for some types of compound dies and double acting dies. These dies are used for deep draws or where flanges or angles are turned to eliminate additional hand shrinking of the metal. For high production work the face of the female portion of the die is faced with thin gage metal, generally of soft cold rolled steel, which after fitting is chrome plated with from .002" to .005" hard chrome plating. These dies do not check, split, crack, or warp, or further deteriorate through long periods in storage.

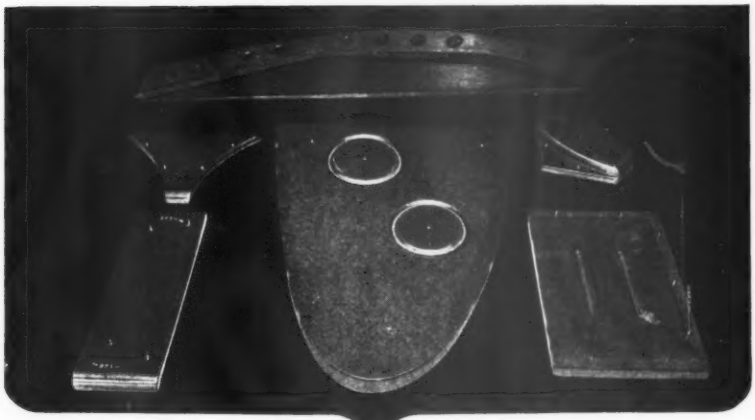
Masonite Die Stock is employed extensively for chucks in spinning of thin sheet metals. The Die Stock is laminated to the necessary size and turned to contour. The metal sheet is then spun in the lathe against the Die Stock chuck. The metal will not freeze or adhere to the chuck since the material is practically inert to expansion and contraction, and is one of the most satisfactory products available for metal spinning.

**This group of chucks for spinning light gages of sheet metal is made of laminated Masonite Die Stock.**

Experience of both airplane and other industrial users indicates that router templates and templates of all types, as well as drill jigs and assembly fixtures made of this material aid in reducing production costs by reducing initial cost of material, weight, tooling time, and rejected parts.

**An important new bulletin "Masonite Die Stock" gives further application data, physical properties, and other information. For your copy, write Masonite Corporation, 111 W. Washington Street, Chicago, Ill.**

• *Assortment of forming dies from Masonite Die Stock. Even the most irregular shapes are easily tooled from this new material.*



# MASONITE DIE STOCK—

## A New Weapon in Industry's Fight against Time!

• Masonite Die Stock is saving *time, weight* and *money* in the manufacture of dies for shearing, forming and spinning of sheet metal, especially aluminum alloys.

• This semi-plastic material was originally developed to speed production in the vital airplane industry, through the famous Guerin Process of forming sheet metals. Now the use of Masonite Die Stock is spreading rapidly to other industries which work with thin gauges of stainless steel, body steel, and aluminum or magnesium alloys, in sheet form.

• Masonite Die Stock is approximately one-sixth the weight of steel. You save on the lower initial cost of this new material, and you save further because it can be processed on all types of high-speed wood-working equipment.

*For further particulars, write to the Masonite Corporation, 111 West Washington Street, Chicago, Illinois.*

**MASONITE CORPORATION**

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## *Designing Dies to Reduce Production Costs*

*(Continued from Page 23)*

and jig bored for extruding and pilot holes. Dummy pins engaging both opposing holes in punch and die serve to locate the punch assembly in its correct position over the die, and clearance for the gages can be scribed on the punches to be milled later.

The punch assembly remains in this position and the punch holder is dropped over the guide pins on top of the punch assembly. After the assembly is clamped to it the punch holder can be removed for screwing and doweling of the punch assembly.

After inserting the pilot and the backing plate in the pad, the pad is slipped between the two punches and the pad guide blocks are clamped in place. After minor adjustments on the whole die assembly, the pad guide blocks are screwed and dowelled to a permanent position.

The die should now be ready for tryout.

The five spring holes will have to be drilled in the punch holder. These holes go all the way through the die and are backed up directly by the ram of the press.

**Estimate**

MACHINING AND GRINDING

Column A—for time values see Table, Fig. 6

| | Machining hr. | Grinding hr. |
|---|---|---|
| DIE—Det. 1—5″x6″x14″.... | 2.5 | 2.7 |
| KEEPER—Det. 2—Two required. 3″x6″x10″..... | 3.4 | 3.6 |
| GUIDE BARS—Det. 3—Two required. 2″x6″x 13½″ ..... | 4.0 | 4.2 |
| GAGES—Det. 4—Two required. ⅜″x5″x6″..... | 1.4 | 2.6 |
| RETAINER PLATE—Det. 5—1″x10″x20″ CRS..... | 2.0 | 1.1 |
| PUNCH—Det. 6—6″x6″x9″. | 2.5 | 2.7 |
| PUNCH—Det. 7—5″x6″x7″. | 2.0 | 2.1 |
| PAD—Det. 8—2½″x4½″x6″ | 1.1 | 1.2 |
| KEEPER PLATE—Det. 9—Two required. 1″x23″x6″. | .7 | .9 |
| PAD GUIDE—Det. 10—Two required. 2″x4″x5″ ..... | .8 | 1.0 |
| | 20.4 | 22.1 |

TOTAL Column A.....42.5 hrs.

DRILLING ALL HOLES EXCEPT FOR PERFORATORS AND PILOTS

Column B—for time values see Table, Fig. 7 (Spring Hole Time Values, see Fig. 8)

DIE—Det. 1—none

KEEPER—Det. 2—Two required. 3 screws, 2 dowels. 2 screws, 2 dowels for gages... 2.0 hrs.

*(Continued on Page 61)*

## Munitions Engraver Speeds Defense Production

*(Continued from Page 29)*

buy any special tools.

The two slider block assemblies, previously required to change reduction settings have been eliminated in the Gorton M-E Munitions Engraver. The design changes in the Model M-E have been made with one idea in mind—to build a machine to do accurate, quantity reproduction of parts in the shortest possible time.

The simplicity of the Gorton M-E design and the much faster speed at which it can be machined and assembled, naturally permit months quicker deliveries. In some cases it may be practical to substitute Model M-E's for standard engravers on orders for long delivery.

Reports from the field on the first few Munitions Engravers indicate that, because of the few adjustments and simple operations, they are readily operated by unskilled workmen, including women, making these machines even more valuable in meeting Defense needs and contributing to relief of labor shortage.

**Bulletin 1635 "New Gorton Munitions Engraver" and Handy Work Sheet 1636, giving full description, detailed specifications and job data on typical applications with production time, also standard and optional equipment complete with prices, will be sent on request. Address George Gorton Machine Co., 1319 Racine St., Racine, Wis.**

# New MUNITIONS ENGRAVER

*Simplified* for FASTER Defense Production

MODEL M-E

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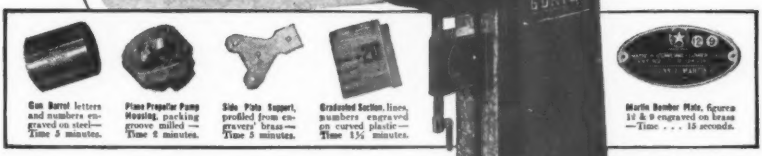

Gun Barrel letters and numbers engraved on steel—Time 5 minutes.

Plane Propeller Pump Housing, packing groove milled—Time 2 minutes.

Side Plate Support, profiled from engravers' brass—Time 5 minutes.

Graduated Section, lines, numbers engraved on curved plastic—Time 1½ minutes.

Martin Bomber Plate, figures 1¢ & 9 engraved on brass—Time . . . 15 seconds.

**THIS NEW GORTON MUNITIONS ENGRAVER** is *simplified* in design for rapid *quantity production* of precision munitions parts.

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GORTON

GEORGE GORTON MACHINE CO.

1319 RACINE STREET, RACINE, WISCONSIN, U. S. A.

## Honing: Stock Removal plus Surface Finish

*(Continued from Page 25)*

The micro-inch, which has been suggested as the yardstick of measurement of surface finish, designates the degree of roughness or the heights and depths of surface irregularity, one micro-inch being equivalent to one one-millionth of an inch. Five micro-inches is easily attainable with modern honing, although in some instances surface irregularities are as little as one and two micro-inches, mere scratches and faint ones at that.

A precise method of indicating surface roughness is known as the root means square (R.M.S. or rms). If the heights and depths of surface irregularities in micro-inches are taken at equally spaced intervals, are measured from a central reference line each measurement squared and an average obtained by dividing the sum of irregularities by the number of points measured, the square root of this average—root means square—is an index of surface roughness. The Profilometer, measures a running average of heights and depths of irregularities and transformed them to electrical voltages automatically by an electric meter calibrated in micro-inches. The reading obtained in the root mean square (runs) average.

The honing process is fundamentally a wet cutting operation. Where it may not be absolutely necessary in some instances to use fluids as coolants, it is essential that the abrasives be well lubricated. It is quite general practice to combine lubricants with a cooling fluid such as kerosene, the action of which in a controlled flow lubricates, cools, and washes away fractured abrasives and cuttings.

It will be recognized that honing has important factors of value for the production manufacturer, the tool and machine shop.

A question frequently asked by prospective buyers of honing equipment is: Does the mechanical type of honing machine have any advantages over the hydraulic type or vice versa? Either type of machine which incorporates accurate and positive control of the travel path of the honing tool can be rated as efficient. Mechanical drive of a traverse motion is absolutely even and true whereas a hydraulic stroke can be "jumpy"—a condition caused by air pockets in the hydraulic lines or by faulty air valves. The "jumpy" condition can be corrected and is corrected by continued precautions. Both types will eventually wear out but the life of each is long and need not be a source of grief if properly cared for. The mechanical type is simple and does not require a highly skilled labor whereas the hydraulic type must necessarily be cared for by an operator with a knowledge of hydraulics. Neither do modern honing machines require experienced grinder hands. The essentials are the ability to make measurements and read micrometers accurately.

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## DEFENSE NOTES

### "Army Purchase Information Bulletin 1940"

THIS is the second revised edition of a pamphlet guide to each War Department procuring agency, giving detailed lists of depots and arsenals and articles purchased by each. Maps show locations of field procurement district headquarters and areas served. The information on the Ordnance Department establishments is complete enough for the guidance of shops that seek specific knowledge of both Arsenal and Ordnance Depot requirements. There is a general index of articles purchased. Copies of "Army Purchase Information Bulletin 1940" may be secured from the Purchase Information Section, Purchase and Contracts Branch Office of the Assistant Secretary of War, War Department, Washington, D. C.

### "How to Sell to the Government for Civilian Needs"

"How to Sell to the Government for Civilian Needs", Industrial Series No. 2, is the latest general information bulletin issued by the Department of Commerce. The procedure for routine Government purchases for all purchasing departments and branches is briefly outlined. A copy of this bulletin will be sent on request. Address United States Department of Commerce, Washington, D. C.

DoAll Band Saws are the finest made—developed to meet today's exacting demands in cutting metals, alloys, plastics—cold rolled nickel, steel, cast iron, zinc, copper, brass, bronze, aluminum alloy, laminated low carbon steel sheets, neoprene, slate, etc.

Above is a 1/8" thick template of rolled steel sheeting cut in 35 minutes on the DoAll.

## SAVE TIME AND MONEY

DoAll Band Saws have been developed by some of today's best metal engineers, to last longer, to run out more work per saw, and to do smoother, speedier work. DoAll Saws are available in every size. Raker tooth, heavy set, A temper, approved by the Office of Production Management on August 20. Ask for list.

EASY TO HANDLE

*Available in various lengths. Each comes in a metal box, with a slot for saw to be pulled out and cut off as required.*

Send for Booklet: **Actual Performance Records of DoAll Saws.**

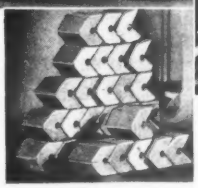
THE DOALL COMPANY

1203 Thacker St. Des Plaines, Ill.

Associated with Continental Machines, Inc., Minneapolis

*Typewriter covers notched out in 5 minutes each. Formerly took 30 minutes to drill and file.*

DO ALL SAWS



*32 dies exactly alike, 1¾" thick, of oil hardening tool steel, sawed in 23½ hours*

*Parts for dies made at C. A. Weidner & Sons, Rochester, N. Y.*

## *The Honing Process, etc.*

*(Continued from Page 33)*

turers, aircraft and other precision parts producers in many industries.

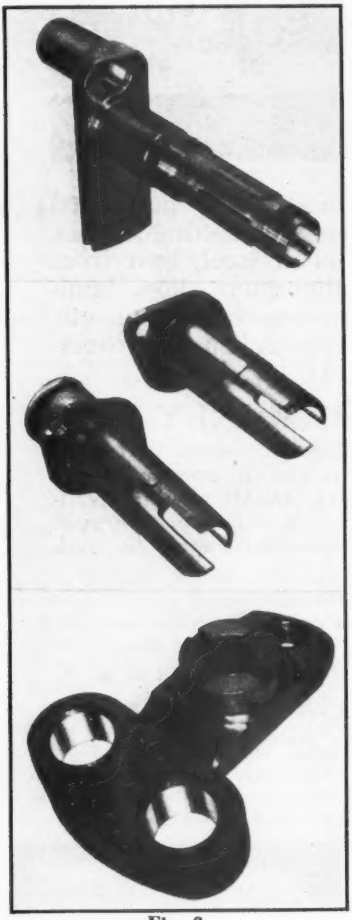


Fig. 3

Honing has made important contributions to the amazing development of aircraft engine performance by providing accurate control of dimensions, minimizing fatigue of metal induced by previous operations, making possible closer control of tolerances and the very smooth finishes favorable to the most efficient lubrication of important bearings. Cylinders of straight-line liquid cooled engines as well as the majority of radial engine cylinders are now finish honed. Advantages of honing cylinder walls of aircraft engines include longer ring life, increased compression and prevention of blow-by and ring flutter.

Other aircraft parts honed as a final finish include crankshafts, knuckle-pin and wrist-pin bores of master connecting-rods (the former honed before and after chromium plating), arm bore holes of propeller shaft, landing gear shock absorber parts, blind end cylinder used in wing-flap actuating mechanism and the three parts shown in Fig. 3.

Honing is of major importance in ordnance work. The generation of gun bores from solid steel forgings is slow and costly and requires maximum maintenance of tools and exceptional care in the various trephining, boring and pack reaming operations. It is reported that with a feed of 6 to 12 inches per hour for a finish boring operation in a bore 4½″ in diameter and 17 feet long, that from 20 to 30 hours per cut is required. A number of installations have demonstrated that honing can follow a semi-finish boring operation, removing considerable stock in a fraction of the time required for generating the cylinder bore.

In the reconditioning of service-worn bores, honing has proven just as efficient. Recently, in reconditioning the worn bore of a gun barrel approximately 16 feet long it was found that the muzzle diameter was 4.457″ and the breech diameter was 4.415″ or approximately .042″ total taper and an estimated .015″ out-of-round. The bore had numerous hard spots caused by the intermittent heating and cooling of firing.

Approximately two weeks were required for

*(Continued on Page 50)*

**TOP—The crank pin hole of a steel forging crankshaft was honed to remove from .001″ to .0015″ of stock from a surface 2″ in diameter by 1½″ long.**

**CENTER—These airplane engine valve tappet guides were honed to remove .001″ stock following a ground finish. Accuracy was held within .0002″ for roundness and straightness.**

**BOTTOM—Two bores in the crankshaft harmonic balancer 2.23″ in diameter and 2″ long were finish-honed in two operations.**

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## A CONCISE, UP-TO-THE-MINUTE MANUAL OF MODERN SHOP PRACTICE

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## A TIMELY CONTRIBUTION TO DEFENSE TRAINING

Prepared in cooperation with leading vocational school and industrial shop training instructors, the popular Starrett Book for Machinists' Apprentices (Vol. I) and the Starrett Machinists' Data Book (Vol. II) have just been completely revised and combined into one volume, providing an up-to-the-minute instruction manual and a ready-reference handbook *for the price of a single book*. Clearly and simply written, profusely illustrated with pictures and diagrams, and completely indexed, this book will prove invaluable to the student or apprentice and will serve as a helpful "refresher" and reference source for the experienced hand. Printed on high grade paper and bound in sturdy, soil-resisting Terek Cloth, the new Starrett Book for Student Machinists is available through distributors of Starrett Tools at only seventy-five cents per copy.

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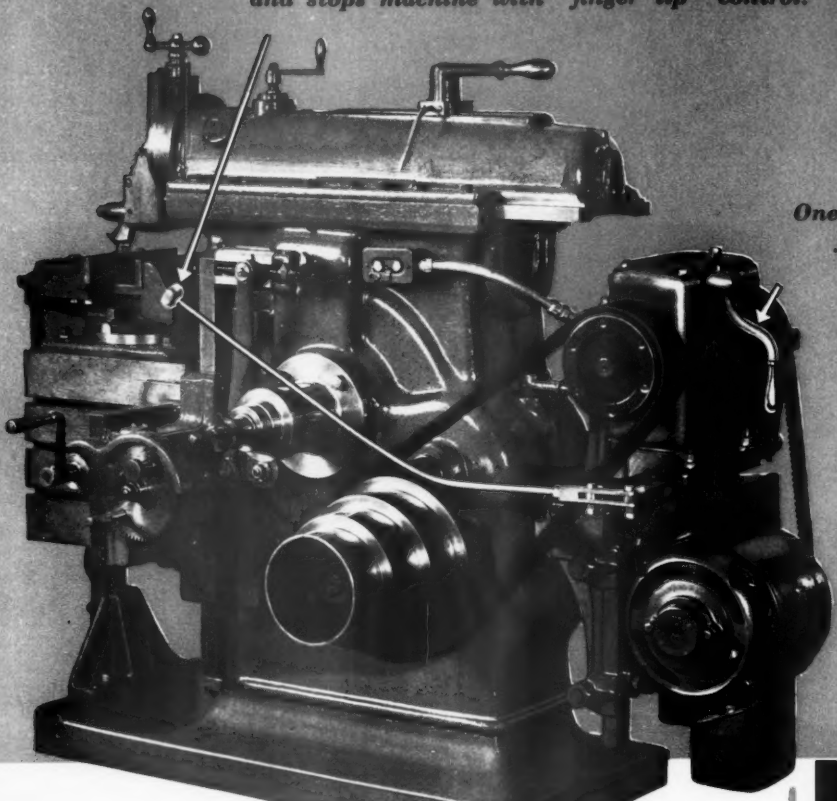
# DRIVE-ALL

**Both three and four speed units are available with either Right or Left-hand power take-off. Drive-Alls are built in two sizes for loads from 1 to 10 HP.**

*Planer application — Clutch control lever starts and stops machine with "finger tip" control.*



*One lever ontro four s ds.*

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*New Bulletin with specifications will be sent promptly.*

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340

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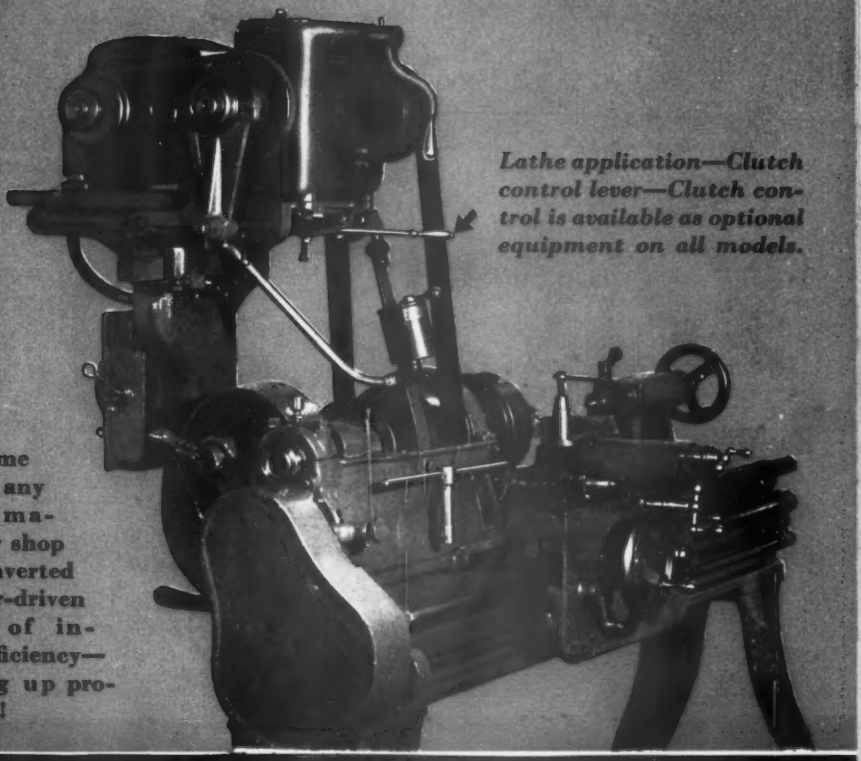
# COMPLETE UNIT TRANSMISSIONS

**The versatile Drive-All Units efficiently motorize machines now belt-driven; they provide manufacturers of new machinery with a gear box to be built into equipment. They serve wherever variable speeds are essential.**



*Lathe application—Clutch control lever—Clutch control is available as optional equipment on all models.*

**...controls ...eds.**

**...average time ...hours, any belt driven machine in your shop can be converted into a motor-driven machine of increased efficiency—stepping up production!**

# DRIVE-ALL

## MANUFACTURING COMPANY

## 3400 Conner Ave., Detroit. Mich.

## *The Honing Process, etc.*

*(Continued from Page 46)*

reboring. The resulting rebore was very rough, since three cutter bars were twisted and broken. The bore was rough honed to 4.500" diameter with mechanically actuated tools (see Fig. 4) in two and one-half hours within an accuracy

**Fig. 4—Representative Mechanical Honing Tools**

of .0005", measured every 10 inches throughout the length of the bore. Approximately .0005" to .0007" stock was removed by finish honing in 10 minutes time, the final surface finish gaging within 5 microinches. This method of processing has now replaced the previous method of lapping following finish boring which was used in a number of the arsenals and which, for lapping alone, required up to one and a half weeks' time.

Gun recoil mechanisms, which include recuperator and buffer cylinders and piston rods used in these cylinders, present a difficult problem since they operate under high hydraulic pressures. The combined requirements for accuracy in machined parts, low tolerance sizing and fitting and maximum smoothness of surface finish and mating of parts is of paramount importance since the final assembly of such mechanisms must be controlled to assure proper operation after storage periods of as long as 10 to 15 years.

Recoil cylinders may be either of monel or forged steel. Many of the parts are reamed to an accuracy within .0005". Before the adoption of straight-line honing tools using bonded abrasive sticks, the bores of such cylinders were lapped with long lapping plugs or finished by a special machine employing an endless belt of abrasive paper which traveled longitudinally through the bore.

Many gun factories now use the honing process following the boring or reaming of recoil cylinders. A rough honing operation is used to remove stock to approximate diameter sizing, and a finish honing operation for final diameter sizing and accuracy. A third straight-line honing operation, uses an adapted form of honing tool fitted with especially wide or interlocked stones (see Fig. 5). Such a design gives a greater degree of controlled cutting action, the interlocked

*(Continued on Page 52)*

**Fig. 5—Interlocking Stones**

# HERE'S A TOOL THAT SAVES MONEY

## DURO *Multiple* SPINDLE DRILL PRESS

Duro Multiple Spindle Drill Presses are built for modern manufacturing plants that want dependable equipment to keep pace with increased production demands.

Greater strength is built into Duro Drill Presses because of heavier and stronger parts. The head castings are heavier and better ribbed than the castings usually found in Drill Presses of this type. The one piece, six splined spindle is rigidly and accurately mounted on New Departure Bearings. The pulley assembly is mounted in a housing which is an integral part of the main head casting. This assembly also is mounted on New Departure Ball Bearings to eliminate all possibility of strain on the spindle.

This extra quality construction has more than enough strength to withstand the stresses and strains developed by high speeds and heavy duty work. If you drill holes from the smallest to full $\frac{5}{8}$" capacity in steel, use tapping attachments or do any other operation that can be done on a Drill Press, you will find this better construction saves time and money—permits higher speeds—heavier cuts with greater accuracy.

*Ask for Complete Details*

The new 1941 catalog, now ready for mailing, fully describes this tool as well as the complete line of new Duro Tools — Address Dept. TP-9 for your copy.

**DURO METAL PRODUCTS CO.**
**2649 N. KILDARE AVE. CHICAGO, ILL.**

## *The Honing Process, etc.*

*(Continued from Page 50)*

stones presenting complete annular abrasive contact at all times. This tool is drawn lengthwise through the finish honed bore. This produces longitudinal, straight-line cutting marks which permit the mating of metal surfaces at a minimum of wear.

On monel metal recoil mechanism cylinders, 2¾" in diameter and 60 to 70" long, a total of .004" of stock can be removed in approximately 5 minutes by rough honing; a total of .001" of stock can be removed in 5 minutes in the finish honing operation; and the straight-line finishing operation can be done in approximately one hour of operating time. On forged steel cylinders approximately .010" total stock is removed in two honing operations in 30 minutes and finished by straight-line honing in 20 to 30 minutes. Accuracy is ordinarily held within .0005" to .0007" for out-of-roundness and total taper.

## Tool and Die Group Schedule Clam Bake

THE Northern Ohio Division, Special Tool, Die and Machine Shop Institute, will hold a Clam Bake Friday, October 3, at Bessie Miller's Broadview Club House, 6048 Broadview Rd. Serving will start at 6:30 P. M. Visiting members of other divisions are cordially invited to attend.

## Air Corps Defines Machine Tool

ACCORDING to the contracting officer of the Materials Division of the Air Corps, the terms "Machine Tool", when assigned to a preferential rating of A-1-A, applies not only to machine tools as such, but also dies, punches, jigs, fixtures, hydraulic presses, measuring devices, furnaces, forging hammers and all instruments and attachments for the operation of machine tools. The same office gives a rating of A-1-B to materials, parts and components of airframes and to materials and facilities for the building of templates and assembly jigs for airframe assembly.


PLASTICS MOLD DESIGNING

By Gordon B. Thayer

Designs for various types of molds are described and illustrated in detail. The book is fundamentally sound, practical and up-to-date. It has won critical acceptance. Here are some of the comments: "A ready reference such as this is invaluable to anyone in the plastics field . . ."; "If you are going into the subject of plastics thoroughly you will want this book . . ."; "Leading features of the book are the strictly modern mold designs and a section on Nomenclature . . ."

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# Defense Notes

## Contract Distribution Division

THE Contract Distribution Division, set up by Executive Order to speed the breaking down of large orders into small units and to facilitate direct negotiation of contracts with groups or individuals, represents an important reorganization change in the OPM. Succeeding the Defense Contract Service, the CDD will operate with an increased headquarters staff in Washington and through offices in thirty-six cities and will rank as a division of OPM.

The President has named Floyd B. Odlum as head of the new division. Wide powers, including the writing of subcontracting requirements into Defense contracts and provision, under certain conditions, for awarding contracts at prices as much as 15 percent above the lowest bids, are expected to speed up production as well as spread subcontracts to plants not now engaged in Defense work.

The plan of operation for dividing contracts among several plants — prime contracts as well as subcontracts—is expected to bring more contract tool and die shops and those industries which have tool, die, jig, fixture and gage making facilities not fully employed, into the Defense program regardless of their size.

Contract shops and industries with facilities for making precision tooling are urged to get in touch at once with their nearest CDD office.

### OPM "Drafts" our Publisher

GEORGE J. HUEBNER, our publisher, has been called to Washington to act as Tooling Consultant in the new Contract Distribution Division. Mr. Huebner, in his long service to the Contract Tool and Die Industry, has been secretary to the Automotive Tool and Die Manufacturers Association of Detroit, National Secretary of the Special Tool, Die and Machine Shop Institute and Industry Code Authority during the NRA. As publisher of The TOOL & DIE Journal, he enjoys wide and intimate contacts in the precision tooling industry.


# New Valuable Dat on Oil-Hardening Stee

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**For high hardness with oil quenching . . . . for deep penetration with minimum distortion or deformation . . . . use Ryerson RY-ALLOY. It's easy to machine and holds a fine cutting edge under rough treatment. RY-ALLOY is a non-shrinking, non-cracking alloy steel. You'll find it economical to use for all general purposes.**

**Send today for more information on RY-ALLOY if you make or use: cams, rolls, thread rolling dies, thread chasers, blanking dies and punches, drill bushings, gauges, plastic forming dies, etc.**

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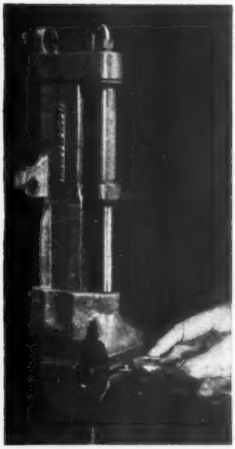


## *Studebaker Puts 5-Ton Hydraulic Vise into Production*

A HYDRAULIC vise, capable of producing pressure up to five tons and designed to speed small press and cutting operations, has been introduced by the Studebaker Machine Co., Chicago, Ill. Its use is particularly recommended in the tool rooms as well as on production lines.

Operation is by foot control, allowing the operator to use both hands in setting up and removing the work piece. The front jaw is stationary, while the back jaw is moved forward by means of a foot pump located in the pedestal and connected with the ram behind the back jaw by a steel tube filled with hydraulic fluid. One pedal moves the vise jaw against the work, while a second pedal applies pressure up to five tons. The jaw is released by means of a third pedal.

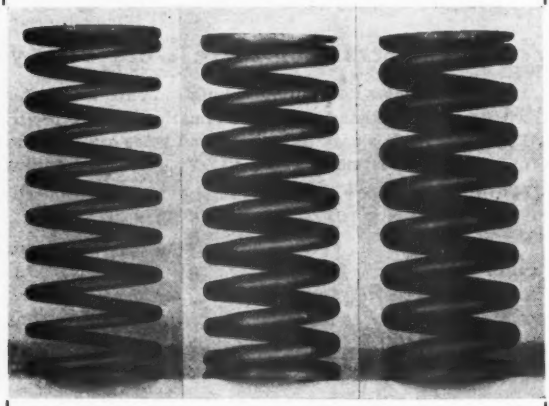
Application of the Studebaker Hydraulic Vise in the speedy press working of metals, punching, bending, cutting, straightening, stamping, etc., is possible. The fact that both hands are free to handle the material and the unusual pressure that may be used, makes it possible to handle heavier and larger work than has heretofore been practical.

A feature that makes this a valuable unit for production operation is the precision fit of the jaws and the fact that it mounts as a fixture on drilling machines, shapers, millers and grinders.

The unit, constructed from steel, has an accurately machined jaw and base which allows precision operation. The pump and ram cylinders are honed to a precision fit. Five inch and seven and one-half inch vise jaws are available.

**Complete details are described in a bulletin which may be obtained by writing Studebaker Machine Co., 19 S. Clinton St., Chicago, Ill.**


**Three Lines of Die Springs**



**We now stock three complete lines of Die Springs: Medium Pressure—50% Deflection; Medium-Heavy Pressure—37% Deflection; and High Pressure—30% Deflection.**
**Heat Treated Alloy and Common Screws—Cerromatrix—Hardsteel Drills—Dayton Rogers Layout Fluid.**

***Ask for new Die Spring Bulletin***

**DIE SUPPLY COMPANY**
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Telephone CHerry 6818
1390 East 30th St. Cleveland, O.

## *Detroit Duplicator Announces "Dudco" Hydraulic Pump*

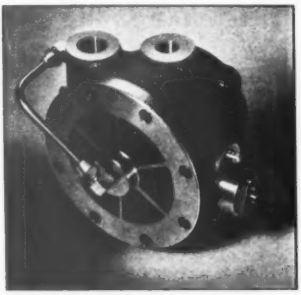
A NEWLY designed dual vane type hydraulic pump, the "Dudco" pump, has been announced by the manufacturer, Detroit Universal Duplicator Co., Detroit, Mich. A unique means of balancing the vanes eliminates overheating, reduces wear and, according to the manufacturer, the Dudco is particularly recommended when continuous operation is necessary or where the possibility of line surges require a "breakproof" pump.

The new pump is recommended for continuous operation at 1250 psi, but it can be used under intermittent, periodic pressures as high as 2000 psi. Delivery is infinitely variable over two ranges; 4 to 0 and 8 to 0 gallons per minute. Rate of flow may be changed while pump is in operation by means of an adjustment screw.

The design of the vanes gives high operating efficiencies and almost perfect balance of the pump. Instead of the conventional single blade vane, the new "Dudco" pump employs dual vanes.

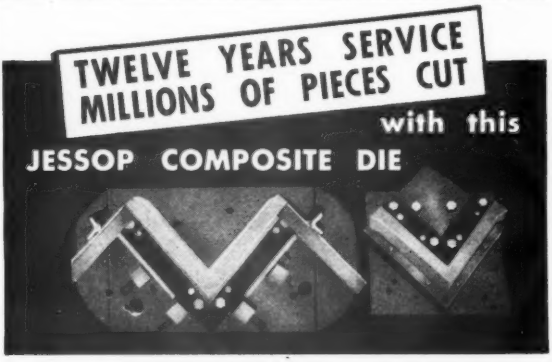
Each vane is bevelled around its entire edge so that oil from the oil hole in the rotor can flow around all edges. Thus a variable "back" pressure can be placed on the vanes from the stator side. With this design the vanes are held against the stator with only a portion of the total operating pressure.

Another feature of the new pump is the split stator construction arranged so that either or both halves can be moved to increase or decrease delivery. Intake and output connections are at the top. Any oil leakage from the inside of the pump into the outer part of the



housing is returned to the intake through

*(Continued on Next Page)*


**Twelve years ago, the John Van Range Company purchased the Jessop Composite Die Sections used in this sheet metal die. Since then the die has been used to cut all types of sheet metal — including ten gauge stainless — and has averaged 200,000 to 300,000 pieces per year. Another Jessop Composite Die at this same plant has been in service nine years and has averaged 150,000 to 200,000 pieces per year.**

**Jessop Composite Die Sections are rolled to shape—eight different sections being carried in stock. Write for handy wall chart which illustrates and lists specifications for the eight shapes available.**

*Photograph courtesy The John Van Range Co., Fifth and Butler Sts., Cincinnati, O.*

★★★ JESSOP STEELS *Serve* NATIONAL DEFENSE

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JESSOP STEEL COMPANY
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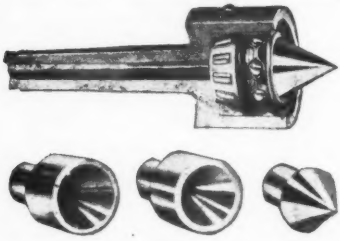
CARBON · HIGH SPEED · SPECIAL ALLOY
STAINLESS and COMPOSITE STEELS

## Ideal Live Center Has Interchangeable Inserts

THE Ideal "Triple-Duty" Live Center, the only center with interchangeable inserts or center pieces, has a special bearing arrangement that permits accurate work with heavier loads at higher speeds. The live center rotates with the work making higher speeds, heavier loads and deeper cuts practical. The radial load is carried by a high precision ball bearing, while thrust load is absorbed by a high precision taper roller bearing. The bearing arrangement assures accurate turning even after long service.



Interchangeable inserts are an exclusive Ideal feature. Three inserts may be used depending on the type of work to be held. The male insert, below at right in illustration, is for work already centered. The plain female insert, center, is used for uncentered work, i.e., drills, shafts, tubes, etc. The female insert with three raised lands, left, is used for uncentered work having flat or burred keyways. Inserts are easily and quickly removable, reducing set-up costs.

All parts of Ideal "Triple-Duty Live Center" are hardened and ground. Male centers are furnished as standard equipment. Centers with straight shanks, Brown & Sharpe or Jarno Tapers are available.

**A four page illustrated Bulletin on the Ideal Live Center gives complete specifications. Send for your copy to Ideal Commutator Dresser Co., 5151 Park Ave., Sycamore, Ill.**

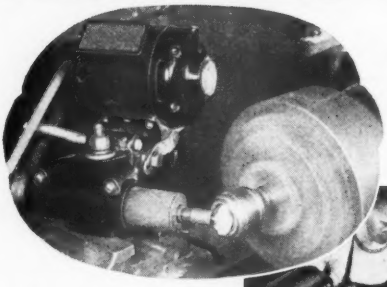
## *"Dudco" Hydraulic Pump*

*(Continued from Page 55)*

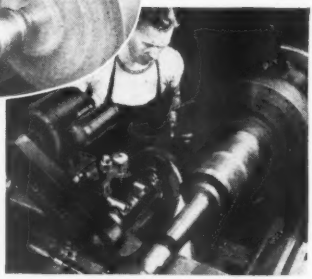
a return line.

**The new "Dudco" dual vane hydraulic pump is manufactured by the Detroit Universal Duplicator Company, 215 St. Aubin St., Detroit, Mich. Write for details.**


# ACCURACY Plus



Grinding the head of a rivet snap is an unusual ship building application of Dumore Precision Grinders that demands accuracy.



If your chief consideration is accuracy and efficiency, with substantial reduction of labor, spoilage and overhead costs, consult your nearest Dumore industrial distributor. He will give you full facts and a shop demonstration at your request. Call on Dumore engineers for consultation on special applications with no obligation.

This Dumore No. 12 at the Gimpel Machine Works, Philadelphia, handles heavy grinding, internal or external, to .0001" accuracy with greatest ease.

**Dumore PRECISION Grinders**

*Write For Valuable Book On*

**PRECISION GRINDING**

**THE DUMORE CO., Dept. 371-J Racine, Wis.**

## Novel Features Distinguish New Automatic Bed-Type Milling Machine

THE Van Norman Machine Tool Company, Springfield, Mass., announce their new Model No. 118, an automatic bed-type, milling machine with hydraulic table feed. Developed for high production milling of small and medium-sized parts, this latest addition to the well-known Van Norman line of millers incorporates many novel features including automatic table cycle, automatic spindle stop, rigid construction and ease of operation.

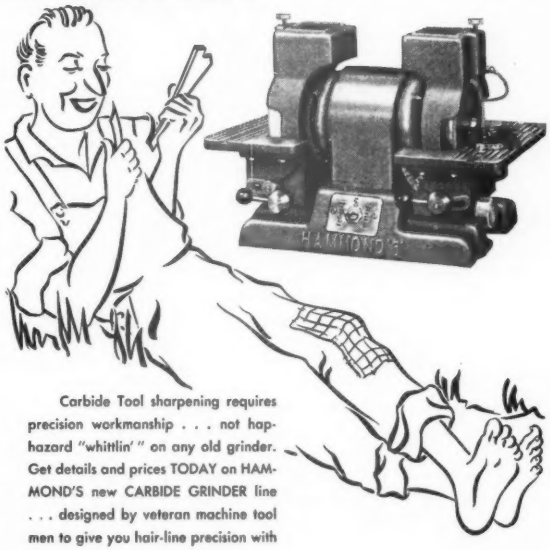
Spindle-speed changes are obtained through pick-off gears; the gear combinations are arranged to obtain any of twelve speeds from 30 to 1000 rpm, in geometric progression. The spindle drive is taken through a vertical shaft to the spindle head assembly, then through large gears to the spindle. The spindle transmission, located in a compartment at the rear of the bed, is driven by a 3 hp motor, hinge-mounted to facilitate belt adjustment to the main drive pulley.

The spindle head slide, one of the unit assemblies of the machine, is mounted on heavy box-type ways, cast integrally with the upright column. A large handwheel, with graduated dial, is provided for raising and lowering the head slide as desired. The front gib of the spindle-head slide is provided with two locking screws so that the head can be clamped securely in place.

The spindle clutch, located in the spindle transmission compartment, is operated hydraulically by means of a clutch lever located in a panel at the right side of the machine. The machine, however, can be provided with an automatic spindle

*(Cont'd on Next Page)*


Whittlin' WON'T DO IT




Carbide Tool sharpening requires precision workmanship . . . not haphazard "whittlin' " on any old grinder. Get details and prices TODAY on HAMMOND'S new CARBIDE GRINDER line . . . designed by veteran machine tool men to give you hair-line precision with simple, easily-operated adjustments.

Hammond of Kalamazoo

HAMMOND MACHINERY BUILDERS, INC.
1631 DOUGLAS AVE. . . . KALAMAZOO, MICHIGAN
Eastern Branch: 71 West 23rd Street, New York City

TEAR OUT . . . MAIL TODAY FOR BULLETINS GP-3 AND 5.

# HEADS YOU WIN!

UNBRAKO

Reg. U. S. Pat. Off.

*famous for years as the*

KNURLED

**SOCKET HEAD**

**CAP SCREW**

*with no premium price!*

Heads you win a definite speed-up on the assembly line or wherever cap screws are used. The "Unbrako" *knurling* gears right to the fingers . . . prevents annoying, time-wasting finger slip . . . permits faster and farther turning of the screw before applying wrench!

Because of this time-saving advantage, and because the knurling also permits quick and easy locking of the screw after countersinking, many plants are now standardizing on *Knurled* "UNBRAKO" exclusively. Make your next order *Knurled* "UNBRAKO" tool

**STANDARD**
**PRESSED STEEL CO.**
JENKINTOWN, PENNA.

Boston
Detroit
Indianapolis
Box 600
Chicago
St. Louis
San Francisco


## Automatic Bed-Type Miller

*(Continued from Page 57)*

stop which provides for automatic engagement and dis-engagement of the spindle in relation to the travel of the table. With this feature, it is possible to start the spindle automatically when the main operating lever is thrown to the rapid advance position, and the spindle automatically stops when the table is reversed.

The normal cycle of the machine is rapid-traverse advance, normal milling feed, then an automatic rapid-traverse return to the starting position. By means of additional table dogs, however, it is possible to obtain skip-stop table cycles.

The hydraulic mechanism for operation of the table comprises a pump and main control panel, together with necessary valves, all of which are located in a compartment at the front of the machine. The hydraulic feed cylinder is mounted on the bed directly under the table and has its pipe connections made through the bed at the main operating panel. Table dogs for automatic control of the main operating panel are located at the front of the table and are easily adjusted as desired.

The main operating panel has a control lever located at the right side which can be set manually to any one of four positions; neutral, rapid advance, feed and return. The Vari-Throttle valve for setting the table feed rate is adjusted by means of a knurled dial that can be quickly adjusted to the desired feed rate.

A one-shot oiling system is provided for the lubrication of the table. The high-low range gears are provided with splash lubrication. Oil for the spindle transmission is added through the pick-off gear box. Hydraulic oil for operation of the table feed is placed in the front compartment of the bed through a large oil cap. The motor can be oiled either through a louvered door shown at the right in the illustration or from a hinged door in the rear.

**Complete information, including specifications and delivery data, on the No. 118 Automatic Bed-Type Milling Machine is now available. Write Van Norman Machine Tool Co., Dept. TD, Springfield, Mass.**

# READ THIS GUARANTEE

**We guarantee the Combination will save its cost in labor alone in six months. You are the judge.**

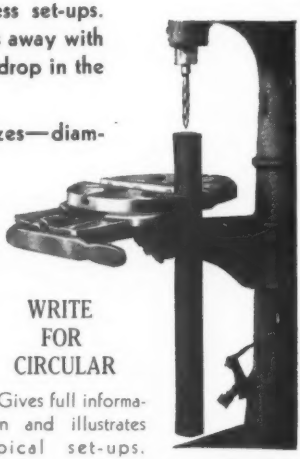
## and ACCEPT our FREE TRIAL OFFER

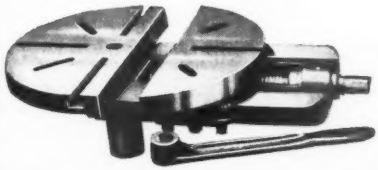
We will ship to rated concerns under this guarantee, on *free trial*. Should you decide not to keep the tool, we will even pay return transportation.

# COMBINATION
## DRILL TABLE AND VISE

Simplifies the most difficult drill press set-ups. Holds work of all shapes securely. Does away with angle plates, clamps and supports. Just drop in the work and start to drill.

The Combination is made in various sizes—diameters from 8″ to 27½″, weighing from 27 to 600 lbs. Made of the finest materials, for long life. Easy to install. Specify the diameter of your shank in thousandths of an inch. We supply the drill table and vise with shank turned to size specified.

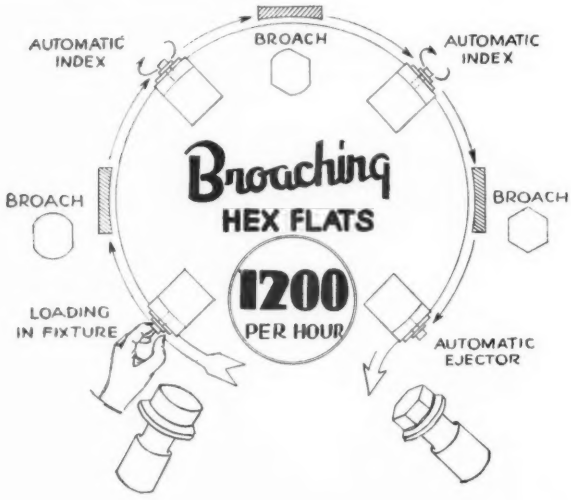


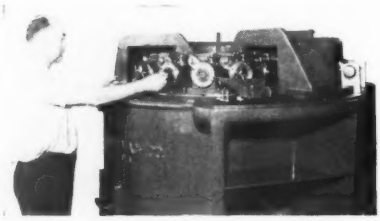


WRITE FOR CIRCULAR

Gives full information and illustrates typical set-ups. Shows use on radial drills. Complete specifications of all models including the square, all steel tables.

**MODERN MACHINE TOOL CO.**
*Jackson, Michigan*



**AMERICAN** recently furnished a large aircraft parts manufacturer a standard American 36″ Rotary Broaching Machine for broaching hex heads on aircraft bolts.

The illustration at the top of the page shows the cycle of the part from loading to ejection.

In the broaching process an accuracy of .001 is held across the flats and the depth of the hex head is maintained within .010.

This is another example of the adaptation of American equipment for high production of defense parts.

**AMERICAN BROACH & MACHINE COMPANY**
ANN ARBOR, MICHIGAN, U. S. A.
BROACHING MACHINES, PRESSES, BROACHING TOOLS, SPECIAL MACHINERY

Division of Sinclair Machine Tool Co.

## *Designing Dies to Reduce Production Costs*

*(Continued from Page 42)*

GUIDE BARS—Det. 3—Two required. 3 screws, 2 dowels.... 1.2
GAGES—Det. 4—Two required. 2 screws, 2 dowels..... 1.0
RETAINER PLATE—Det. 5—6 screws, 4 dowels for keeper 6 screws, 4 dowels for guide.. 1.8
DIE SHOE—12 screws, 8 dowels, 4 air pins, 1 clearance hole for pilot ..... 2.6
PUNCH—Det. 6—3 screws, 2 dowels ..... .6
PUNCH—Det. 7—3 screws, 2 dowels ..... .6
PAD—Det. 8—4 screws..... .5
KEEPER PLATE—Det. 9—4 screws ..... .5
PAD GUIDE—Two required. 2 screws, 2 dowels..... 1.0
PUNCH HOLDER—10 screws, 8 dowels ..... 1.9
SPRING HOLES—5 required (Fig. 8) ..... 2.5

TOTAL Column B.....16.2 hrs.

LAYOUT AND INSPECTION

Column C—for contour time values see Tables, Figs. 9, 10, 11, 12

*Layout*

DIE—Det. 1—6 units as indicated ..... .6 hrs.
3 holes for extrusions and pilot 6 units ..... .6
KEEPER—Det. 2—none
GUIDE BARS—Det. 3—none
GAGES—Det. 4—3 units each as indicated or 6 units..... .6
RETAINER PLATE—none
PUNCH—Det. 6—2 units as indicated ..... .2
PUNCH—Det. 7—2 units as indicated ..... .2
PAD—none
KEEPER PLATE—none
REST—none

2.2

*Inspection*

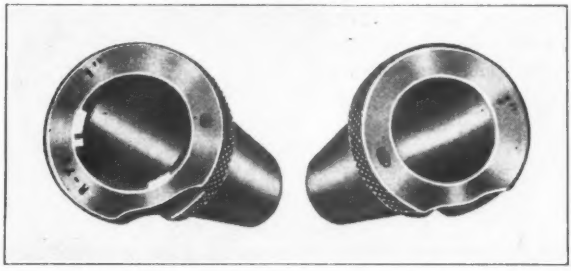
.5 hrs. for each of the above pieces ..... 2.5

TOTAL Column C ..... 4.7 hrs.

*(Continued on Next Page)*


**A DOUBLE BARREL SHOT**

**at bushing requirements**



**The A. S. A. and Acme Standards together give the most complete range of bushing sizes available.**

**This means a Standard bushing for nearly every requirement, less chance of delay through ordering "specials", and therefore greater convenience and speed in the manufacture of your jigs. (See page 2 of our bushing catalog.) Write for your copy today.**

**ACME INDUSTRIAL COMPANY**

*Specialists in Flat and Cylindrical Lapping*

**206 N. Laflin St. Chicago, Ill. MONroe 4122**

*Our Reputation is Based on the*

**Precision Gages and Dies**

we have been building for years to meet the most rigid requirements of leading users of Precision Gages, Gaging Fixtures and Small Stamping Dies.

The skilled workers in our organization have been carefully trained—their pride of workmanship plus the use of the latest and most modern equipment and methods are assurance that exacting standards are always met.

An addition to our plant, soon to be ready for use, will expand our ability to serve more manufacturers.

*Let us quote on your urgent precision work*

**TOOLS & GAGES, INC.**

**3106 E. 63rd St., Cleveland, O.**

*Designers and Builders of Fine Gages and Precision Dies*

## *Designing Dies to Reduce Cost*

*(Continued from Page 61)*

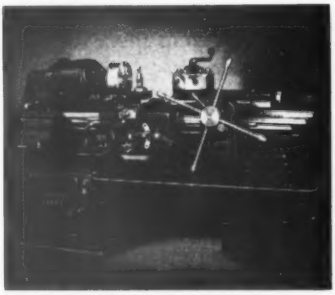
| | |
|---|---|
| MACHINING, FINISHING AND FITTING DIE PARTS | |
| Column D—use contour units as established for Column C, also Drawings and Tables, Figs. 13-20 | |
| DIE—Det. 1—Right side: 3 units, 18 sq. inches x 1" average depth, less 50% of 7 hrs. (Fig. 19) | 3.5 hrs. |
| Left side: 3 units, 18 sq. inches x 2" average depth, less 50% of 14 hrs. | 7.0 |
| Plus 20% for finishing | 2.1 |
| 2 Keeper Shoulders 8 sq. inches x ¼" deep, 2 units, 2 sides | 1.2 |
| KEEPER BLOCKS—Det. 2—Two required. For milling shoulder same as above | 1.2 |
| GUIDE BARS—none | |
| GAGES—Det. 4—Two required. 3 units each x 6 sq. inches each x ½" deep | 1.6 |
| Plus 20% for finishing | .3 |
| PUNCH—Det. 6—Same as Die —Det. 1—Right side | 3.5 |
| PUNCH—Det. 7—Same as Die —Det. 1—Left side | 7.0 |
| Plus 20% for finishing | 2.1 |
| For shoulder to form keeper on each punch—24 sq. inches x ½" deep | 3.6 |
| Clearance for Gages—3 units on each side 12 sq. inches x 1½" deep | 7.6 |
| TOTAL Column D | 40.7 hrs. |
| PERFORATORS, PILOTS AND THEIR CORRESPONDING HOLES | |
| Column E—see Table and Drawings, Figs. 21-26 | |
| EXTRUDING PUNCHES—Two required. Type 2 | 1.4 hrs. |
| PILOT—One required. Type 2 | .9 |
| AIR PINS—Four required | .5 |
| HOLES FOR EXTRUDING PUNCHES AND PILOTS—1.3 hr. each | 3.9 |
| TOTAL Column E | 6.7 hrs. |
| ASSEMBLY, TRYOUT, DEVELOPMENT | |
| Column F—see Table, Fig. 28, and accompanying text | |

*(Continued on Next Page)*

| | |
|---|---|
| DIE—Det. 1 | 1.0 |
| KEEPER—Det. 2—.5 hrs. each | 1.0 |
| GUIDE BARS—Det. 3—.5 hrs. each | 1.0 |
| GAGES—Det. 4—Two required. 1 hr. each | 2.0 |
| RETAINER PLATE—Det. 5 | 2.0 |
| PERFORATORS AND PILOT | 1.5 |
| PUNCH—Det. 6 | 1.0 |
| PUNCH—Det. 7 | 1.0 |
| PAD—Det. 8 | 1.0 |
| KEEPER PLATE—Det. 9 | .5 |
| PAD GUIDES—Det. 10 | 1.0 |
| TRYOUT | 15.0 |
| DEVELOPMENT | 8.0 |
| TOTAL Column F | 36.0 hrs. |
| Estimated hours of labor required | 146.8 or 150 hrs. |
| Add 10% for large die. Total | 165 hrs. |

## South Bend Announces New 16″ Turret Lathe

THE South Bend Lathe Works, South Bend, Ind., announces a new 16″ swing turret lathe designed for rapid production on chucking operations and bar work. The new lathe is versatile and adaptable for many of the shortrun and semi-production jobs so often done in the Contract tool room.



The ram type turret has both power feed and hand feed—automatic indexing and individual stops are provided for each of the six turret faces. A quick change gear box provides 48 changes of turret power feeds, also 48 changes of both the cross and longitudinal feeds for the turret post carriage and a series of 48 screw threads, 4 to 224 per inch. Provision is made for changing the di-

*(Continued on Next Page)*

**ALLENS**

**pack the strength *with accuracy* for close-tolerance work**

For accurate locating of work and rigid retention of assemblies, Diemakers specify "ALLENS",—the *complete* line of Hexagon Hole Products and Diemakers' Accessories, 30 years in the making by *Specialists.*

The Hollow Screws are made from ALLENOY steel, heat-treated, instrument-tested for each physical property, and individually hand inspected. Thread-accuracy has been brought to perfection with Allen-developed lead screw threading machines and the new "Duo-process". Sockets are true and clean. Heads always concentric with screw bodies.

The Dowel Pins (like the Hollow Screws) are made from ALLENOY steel, ground to close tolerance limits, with tensile strength of 240,000 to 250,000 lbs. per square inch.

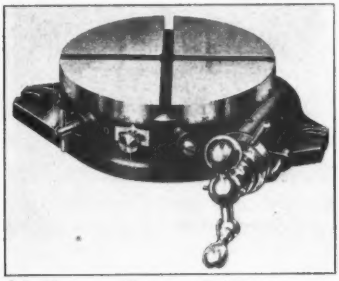
Full technical data in Folder G T-21,—mailed to you on request.

*Call your local Allen Distributor for free samples and service.*

**THE ALLEN MANUFACTURING COMPANY**
**HARTFORD, CONNECTICUT, U. S. A.**

## *Vernon 7" Rotary Table Now in Production*

IN response to steadily increasing tool room and die shop demands for a compact and versatile rotary table, the Machinery Manufacturing Co., Los Angeles, Cal., are putting their new 7"



model Vernon Rotary Table into quantity production. The entire unit is constructed for heavy-duty use, and the table is substantially ribbed to prevent distortion.

The low table level (only 2¾") affords maximum working space; each of its four quadrants is graduated in degrees from 0 to 90, and its friction loaded worm dial is calibrated into 240 minutes, insuring instant and easy setting.

Table movement is registered against an adjustable point. Worm gear is hobbed integrally with the table, and worm may be readily disengaged to permit free wheeling of table. Positive setting is assured by a quick-setting thumbscrew type lock.

**Information on the Vernon 7" Rotary Table may be obtained from Machinery Manufacturing Co., 1915 E. 51st St., Vernon Sta., Los Angeles, Cal.**

## South Bend Turret Lathe

*(Continued from Page 63)*

rection and speed of the turret feeds with relation to the carriage feeds.

Twelve spindle speeds ranging from 10 to 731 rpm are available. A two-speed motor permits quick change from high to low speed for reaming and tapping operations.

**Complete information on the new South Bend 16" Turret Lathe will be forwarded promptly on request. Address South Bend Lathe Works, Dept. T6, South Bend, Ind.**


# Pot Harden and Melt Faster at Less Cost!

## JOHNSON Furnace No. 570

Here's the most efficient furnace yet devised for economical lead, cyanide and salt hardening, and the melting of aluminum and brass! Saves up to half the gas of ordinary units, and produces maximum temperatures in less than 30 minutes! The correct placement of the 4 burners gives a fast rotary flame, and uniform high temperatures. Offers big advantages to tool, die and pattern makers, and case-hardening and melting plants. Equipped with G. E. motor, large Johnson blower and steel pot 14"x20". $248 F.O.B. Factory.

*Prices Subject to Change without Notice.*

*Other sizes available. Send your own specifications for price quotation.*

Look 40th ANNIVERSARY YEAR

JOHNSON GAS APPLIANCES FOR EVERY INDUSTRIAL PURPOSE

FREE—*New Catalog of Johnson Gas Appliances. Write for Yours today!*

**611 E AVE. N.W., CEDAR RAPIDS, IOWA**

## *Hammond Offers New "OK" Grinders*

HAMMOND Machinery Builders, Inc., Kalamazoo, Michigan, announce three new, functionally streamlined grinders. Designed for tool and light snagging grinding, the units feature oversize construction for all moving parts such as spindles and bearings. The totally enclosed heavy-duty motor is streamlined into the top of the base which is attractively "wrinkle" finished. The Hammond "OK" Grinders (10"-1 HP, 12"-2 HP, and 14"-3 HP) are heavier, precision machined, reinforced at stress points—designed throughout to give maximum service. All three models are floor pedestal with the 10" model available also as a bench grinder.

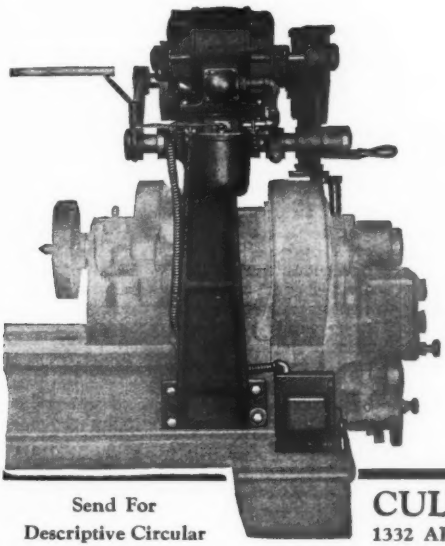
A few modern features of the "OK" are: adjustable spark deflectors; heavy, exhaust-type, semi-steel guards, tool tray and removable water pot; push-button starter; and adjustable tool rests.

"OK" Grinders are also furnished as a combination grinder-buffer, or with each end of the spindle extended to form a buffing and polishing lathe.

**New Bulletin GP-12 "The New Hammond 'OK' Line" containing full information is available. Address Hammond Machinery Builders, Inc., 1631 Douglas Ave., Kalamazoo, Mich.**


# MOTORIZE WITH *CULLMAN DRIVES*

*for* NATIONAL DEFENSE



Rigidly constructed and easily installed on lathes, shapers, milling machines, punch presses, these drive units are designed to increase machine efficiency 25% or more and still retain belt drive smoothness.

Efficiency of old machinery which has been pressed into service due to Defense demands can be increased to equal that of new equipment. Machines equipped with Cullman Drives require less space and may be arranged to obtain better lighting.

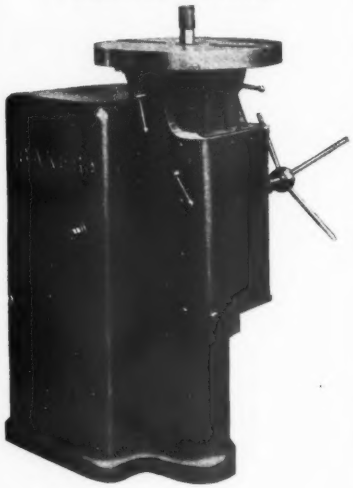
Cullman Drive Units are made in sizes for motors ranging from ¼ to 15 hp.

Send For Descriptive Circular

**CULLMAN WHEEL CO.**
1332 ALTGELD ST. CHICAGO, ILL.

*Save* Valuable Tool, Gage and Die Making *Time*
by using

*BAKER*
Contour Grinder



TOOL ROOMS AND DIE SHOPS WILL RECOGNIZE THESE NUMEROUS ADVANTAGES:

Convenient working height, complete visibility.

Vertical spindle mounted on large precision anti-friction bearings. Three speeds from Vee Belt drive.

Cam actuated reciprocating action, which can be disengaged when dressing the wheels.

Well ribbed 18" table with T-slot to front and rear. Mounted to provide angles for grinding of angular relief in dies, etc.

Wheels quickly interchangeable and held securely.

Quick acting capstan control of table slide.

Assembly protected against grindings and dirt.

*For full details, write today for Contour Grinder Folder*

**BAKER BROS., INC.**
TOLEDO OHIO

## Midwest Tool & Mfg. Co. Issues New Catalog

MIDWEST Tool and Manufacturing Company, Detroit, announce their new Catalog No. 17, a 192-page book bound in red morocco and containing information on the complete line manufactured by this company. Data on tools and holders, including counterbores, countersinks, drills and reamers of all kinds, form tools, milling cutters, keyway cutters, spot facers and spot facer bars, adjustable extension and floating holders, and every type of design and variety of carbide tipped tools, are included.

The new catalog is liberally illustrated with photographs and drawings and all types of tools and holders have identifying style numbers and accompanying specification tables of sizes and dimensions. Tables of feeds and speeds, cutter-sharpening data, conversion tables

and other useful information are also included to make this catalog of particular value to tool room and die shop men.

**For your copy of new Catalog No. 17 write Midwest Tool and Mfg. Co., 2366 W. Jefferson Ave., Detroit, Mich.**

## Timken Converts Tube Mill To Speed Shell Production

THE Assel seamless tube piercing mill, invented and developed by The Timken Roller Bearing Company, has been converted into a shell mill which produces shells twice as fast as the conventional forging methods now in use. Five mills are producing shell blanks for the United States and Great Britain.

## Detroit Tap and Tool Increases Thread Gage Production

TO meet accelerated Defense Production needs, a line of high precision thread gages for checking both internal and external threads on various sizes and types of shell has been brought out by Detroit Tap and Tool Company, Detroit, Michigan. They are already in use in several large shell manufacturing plants in the middle west.

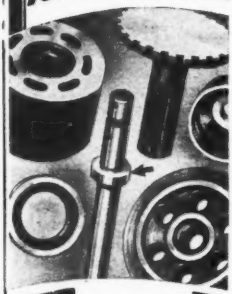
Threads of the Detroit shell thread gages are precision ground and precision lapped with precision ground thread-laps. A high wear-resisting alloy is used, developed especially for the purpose.

Plug gages for checking internal threads are of the reversible type, virtually doubling useful life of the gages. Ring gages are adjustable and may be reconditioned and reset with the use of precision ground Detroit setting-gages when worn. The gages are shipped adjusted and locked in position for immediate use.

Gage production facilities of Detroit Tap and Tool Co. are now undergoing further expansion. The expansion provides particularly for increased manufacturing facilities on large thread, plug and ring gages, 2 inches diameter or over, as used in shell production, etc.

**Further information will be sent at your request. Address Detroit Tap and Tool Co., 8434 Butler Ave., Detroit, Mich.**


**Flatter, Smoother, Surface Finishes for YOUR PRODUCTION PARTS** ★★★



IF YOU make aircraft landing gears, thrust bearings, oil seals, valve plates, tool blocks, seal rings, clutch plates, refrigerator seals or other parts that call for a precisely flat, smooth surface finish. . . . Ultra-Lap will finish such parts for you, to an optically flat surface . . . to specifications for flatness of one light band or less . . . to a smoothness finish as low as one micro-inch R.M.S. . . . any metal or material, or any combination thereof. Now serving leading manufacturers in the Aircraft, Automotive, Refrigerator and other fields . . . we engineered and are builders of the famous Ultra-Lap Machines with which this Lapping work is done. Send your specifications for estimate of cost to:

**Ultra Lap Machine Company**
245 McDOUGALL AVE., DETROIT, MICH.

# Recent Industry Publications

**"FIRTHITE GENERAL PURPOSE TOOLS"**—This Bulletin gives sizes and prices of the five styles of Firthite Tools and four grades of Firthite sintered carbides. Recommendations for the use of each grade are given. The two grades of Firthite Tools for cutting steel have a chip-breaker ground into the carbide. In addition to the data on the styles of finished General Purpose Tools which are ground and ready for use, this Bulletin outlines the complete sintered carbide service offered by this company. Blanks or tips, milled and brazed tools, drawing dies, mandrels and wear parts such as gages, punches, dies, bearings and special applications, are a part of this service. For a copy of "Firthite General Purpose Tools" write Firth-Sterling Steel Co., Dept. TD, McKeesport, Pa.

**HARDINGE PRECISION TOOL ROOM MILLING MACHINE**—Bulletin TM describes this sturdy, extremely accurate and easy-to-operate mill designed to do the majority of tool room and laboratory operations. Ten features include eight spindle speeds, enclosed column with "Connected Bearing" design, large working surface of table (20¾" x 6") and overarm of solid steel, hardened and ground. The regular equipment and attachments including Hardinge Universal Index Centers, 1" Collets (Hardinge 5c), swivel vise and arbor are also described. Write to Hardinge Brothers, Inc., Elmira, N. Y., for your copy of Bulletin TM.

**WELLS METAL-CUTTING BAND SAW**—A new 4-page Bulletin on the two sizes of metal-cutting band saws includes complete specifications. For your copy write Wells Mfg. Corp., Three Rivers, Mich.

**NEW TURRET LATHE TOOL CATALOG**—The complete line of Gisholt Turret Lathe Tools for use on ram and saddle types of turret lathes is described and illustrated in a new 168-page loose-leaf catalog just published by the manufacturer.

One hundred sixty-four tools (many of them not previously announced), built in more than 500 sizes, are completely illustrated in three colors and short easy-to-read descriptions of each are given. Nearly 500 illustrations are employed to show pictures of each tool, its application and its principal dimensions. Dimension drawings are large enough to permit direct scaling to layout sheets and the individual file-size pages may be removed from the book for reference without tearing out, preserving the permanent reference value of the book. Such unique features as completely-pictured suggested standard sets of tools for a specific size of machine and type of work, a cross-referenced ten-page index of all tools, and a separate section devoted to attachments which may be added to present turret lathes, make the catalog particularly valuable to turret lathe users in the present Defense emergency, since they suggest additional methods of increasing production with present equipment.

Copies of the catalog will be supplied only to those who write direct to the Gisholt Machine Co., 1193 E. Washington Ave., Madison, Wis. Turret lathe users can secure the catalog at no cost by writing on company letterhead, listing the make and model of machine used and the writer's title or occupation. All others, including students and teachers, can secure a copy by accompanying their request with a remittance of $2.50 to defray cost of printing and mailing.

**"MODERN METHODS OF GARDNER-GRINDING"**—This spiral bound book, printed in color, illustrates modern methods of grinding with Gardner grinders, ranging from simple hand-operating disc grinders and fixtures to high production, single purpose machines. The correct grinder and procedure for finish-grinding the stem end of valves; double-disc grinding; grinding both ends of large coil springs simultaneously and job-grinding the sides of tapered bearing cones (to mention only a few) are described and illustrated. Specifications and grinding time of each machine, the production rate and tolerances maintained are given for each application described. For your copy of this interesting booklet, address Gardner Machine Company, Dept. GM, Beloit, Wis.

**"THE STRAIGHT LINE TO METAL WORKING EFFICIENCY"**—This new 48-page handbook, distributed by the D. A. Stuart Oil Co., discusses the subject of metal cutting lubricants and recommends and illustrates by every day examples the solutions to many tough application problems. Of particular value is a section of tables devoted to official SAE Standard Steel Specifications, an explanation of the SAE Numbering System and a Hardness Conversion Table. Engineering and quick delivery service points are conveniently listed. A copy of "The Straight Line to Metal Working Efficiency" will be sent on requests made to the D. A. Stuart Oil Co., 2733 S. Troy St., Chicago, Ill.

**"ROTARY VIBRATING RIVETERS"**—Bulletin G details in considerable length the outstanding construction and operating features of the 7 Grant Rotary Vibrating Riveters. Directions and specifications for easy ordering occupy a prominent place in Bulletin G. Noiseless Rivet Spinning Machines and Special Machines are also manufactured by the Grant Mfg. and Machine Co., Dept. TD, Bridgeport, Conn. Bulletin G or information on other machines in their line will be sent upon request.

**STOKES COMPLETELY AUTOMATIC MOLDING MACHINES**—According to the manufacturers Catalog No. 906 these machines greatly simplify molding practice by taking the guess work, the rule-of-the-thumb and element of human error out of molding methods. The automatic molding machines in the Stokes line are all illustrated in Catalog No. 906. A partial list of users of Stokes automatic molding machines, Molding Cost Studies and a Material Production Conversion Table will prove of value. A copy of Catalog 906 will be sent by F. J. Stokes Machine Co., 5928 Tabor Rd., Olney P. O., Philadelphia, Pa., upon your request.

*(Please turn to Page 70)*

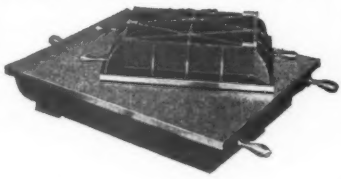
# SHOP AIDS

**THE STARRETT BOOK FOR STUDENT MACHINISTS**—This new reference manual, prepared in cooperation with leading vocational school and industry shop training instructors, is a complete revision and combination of the Starrett Book for Machinists' Apprentices (Vol. I) and the Starrett Data Book for Machinists (Vol. II), each long popular. Written simply and clearly, the new book of 184 pages contains over 200 diagrams and illustrations and 30 reference tables. The book is arranged so that it can be used as a reference source by the experienced shop man as well as a basic text for the student and apprentice. The book, which sells at 75 cents per copy, the cost of each previous book, is available through distributors of Starrett Tools.

**"ENCYCLOPEDIA OF MACHINE SHOP PRACTICE"**—A new 576-page book containing nearly 1000 illustrations and diagrams and 2800 essential items has just been published. Designed for "upgrading" apprentices, machine operators, toolmakers, etc., the encyclopedia, written in simple, understandable language for the student, was compiled and edited by Professor George W. Barnwell of Stevens Institute of Tech-

*(Continued on Page 71)*


## MILWAUKEE SURFACE PLATES



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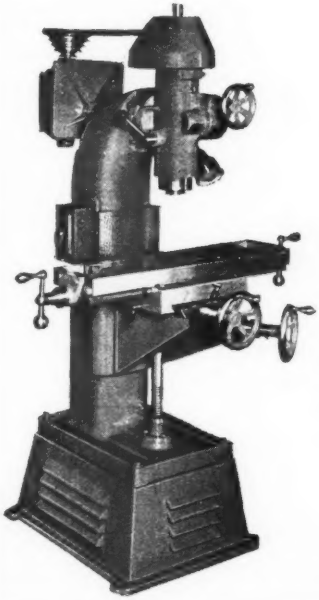

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A new plant with increased facilities has made it possible for us to accept a limited number of orders for prompt shipment. High Grade in every respect and especially designed for High Speed Precision and Production Milling and Boring.

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**Jackson Machine & Tool Company Sales Division**

**956 Roberts St. Jackson, Michigan**

## Recent Industry Publications

*(Continued from Page 68)*

**NEW AND IMPROVED WALLS ABRASIVE BAND GRINDERS**—For roughing, smoothing and fine finishing—are the subject of Catalog No. 41. Six abrasive band grinders and 3 abrasive band and disk grinders are described and illustrated and specifications for each are given. The variety of finishes possible and the increased production make these grinders desirable for finishing parts made of steel, iron, brass, hard rubber, copper, aluminum, celluloid and Bakelite. Send for Catalog No. 41, giving complete description and specifications of these new abrasive band grinders. Address Walls Sales Corp., 94 Warren St., New York, N. Y.

**CIRCULAR RELIEF GRINDING**—may be successfully accomplished with the Cleveland Circular Relief Grinder. This machine is now being used by both large and small shops for the manufacture and maintenance of reamers, taps, milling cutters, form tools, boring heads, etc. Because it eliminates breakdown of the cutting edge and because it leaves every particle of metal possible to support the cutting edge, users claim that this machine gives them from 3 to 5 times more pieces per grind. Bulletin CT, describing and illustrating this Circular Relief Grinder, also illustrates a few of the many applications of this method of performing an essential, and formerly difficult, operation. Send for your copy. Address The Cleveland Tool Engineering Co., 9200 Detroit Ave., Cleveland, O.

**TORFLEX FLEXIBLE BEARINGS**—General engineering data, including operation characteristics for various standard size Torflex flexible bearings now carried in stock are given in a new 8-page folder just issued by Harris Products Co., 5432 Commonwealth Ave., Detroit, Mich. Data includes radial loads, radial and axial deflections, rubber wall thicknesses, etc., of stock sizes available from ⅛ to 5-inch diameters. Also shown are some typical applications of Torflex bearings in a range of uses from heavy duty cement mill supports and drag line scraper drives to a rayon spinning bobbin where the elimination of vibration at high speeds prevents breakage of single thread silk during winding. Send for your copy of "Torflex Flexible Bearings" today.

**"NEW WINGS FOR PRODUCTION"**—New and unusual facts on how leading aircraft plants are meeting their "tooling-up" crises are revealed in this attractive booklet. Numerous photographs of actual plant set-ups show some of the secrets of the amazing growth in production capacity of such concerns as Bendix Aviation Corp., Consolidated Aircraft, and North American Aviation. In particular, this booklet emphasizes the clever adaptations of the new type low-cost precision machines—drill presses, cut-off machines, metal cutting band saws and circular saws—designed to meet the urgent needs of the rapidly expanding aircraft industry. Of unusual interest is the series of photographs of special set-ups made at low cost with standard drill press parts for use in airplane engine production. For your copy of "New Wings for Production", address Delta Mfg. Co., 611-H E. Vienna Ave., Milwaukee, Wis.

**"SOUTH BEND PRECISION LATHES"**—This new 8-page catalog may be placed in a binder or filed in a standard letter file. The condensed data includes illustrations, basic dimensions capacities, speeds and feeds of back-geared, screw cutting lathes having 9, 10, 13, 14½ and 16-inch swings, with bed length from 3 to 12 feet. Numerous attachments for tool room and production work are illustrated and described. Copies of this catalog, No. 52, are available upon request from South Bend Lathe Works, Dept. T6, 200 E. Madison St., South Bend, Ind.

**"OHIO HORIZONTALS"**—Both the horizontal and table type boring, drilling and milling machines manufactured by The Ohio Machine Tool Co., Kenton, O., to minimize the handling of machine work during the process of production, thus reducing the floor-to-floor time, are described and attractively illustrated in this booklet. The table type machines are capable of performing boring, drilling and milling operations at high speeds and light cuts or slow speeds and heavy hogging cuts. Three specification sheets for the table type horizontal boring, drilling and milling machines, giving a large range of specifications to make it possible for the user to choose a machine to suit his individual needs, are included. Your copy of "Ohio Horizontal" and general specification sheets will be sent at your request.

**TORIT DUST COLLECTORS**—These self-contained units, for carrying away dust-laden air around grinding, cutting and polishing wheels, are described and illustrated in Bulletin T, issued by the Torit Mfg. Co., Walnut & Exchange Sts., St. Paul, Minn. Torit Dust Collectors recirculate the air drawn from grinding wheels. After the air is cleansed by passing through the filter bags, it is exhausted back into the room, resulting in no loss of heat. Numerous uses for these units are listed. Complete specifications and prices are included. A copy of Bulletin T is available upon requests made to the Torit Mfg. Co.

**"AMERICAN" NEW RADIAL**—Form 3M is a well illustrated booklet describing the "American" Hole Wizard, "the newest new radial". Twelve spindle speeds, covering a standard range of 50 to 1500 rpm, are secured by two conveniently located direct reading levers placed at the lower right hand side of the head. All speed-changing mechanism is located in the head casting. Diagrams showing mechanism for securing 12 spindle speeds; showing automatic circulating oiling system for the entire head mechanism; and a diagram of spindle assembly, all add to the interest and value of this booklet. Spindle Drive, automatic oiling, power feeds, elevating mechanism, etc., are all described in detail. For your copy of Form 3M, address The American Tool Works Co., Dept. AT, Cincinnati, O.

## SHOP AIDS

*(Continued from Page 69)*

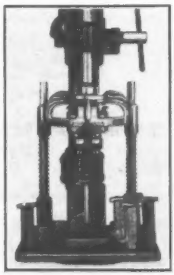
nology with the aid of a number of experts in various branches of metal processing. An enormous first edition—300,000 copies—makes it possible to sell the book for $1.98 (tab index, deluxe edition $2.48). Such sections of the book as "Bench Work", "Jigs and Fixtures" and "Pressing, Stamping and Punching" will have particular appeal to men in the Tool and Die Industry. Detailed explanations of the operations of standard machine tools, a large number of tables and a complete title index are included. Copies can be ordered from The Tool & Die Journal, 2462 Fairmount Blvd., Cleveland, O.

**HANDBOOK ON CONTOUR SAWING**—Of particular interest to vocational teachers, NYA officials and trainees is the new Contour Sawing Handbook published by Continental Machines, Inc. The Handbook contains 158 pages devoted to illustrations and guide charts, covering all phases of contour sawing and filing of metals to any desired shape. Section I of the book compares contour sawing with other machining processes with the shaper, nibbler, lathe, miller and torch cutting. Section II illustrates applications and work accomplished

*(Continued on Page 72)*


**LINCO *Two Spindle***
**Adjustable Drill Head**
**Also Adaptable for Tapping**

**Drills two holes at once, made in several sizes, drill centers ½" to 6", speeds up to 3600 RPM, capacity drills 0" to 5/8". Total weight of small head, with aluminum gear case, only 9½ lbs. Equipped with roller and ball thrust bearings. Especially engineered for Canedy Otto, Demco No. 15 and similar drill presses—also suitable for use on larger drill presses.**



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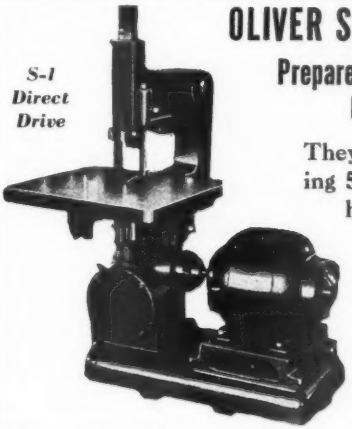

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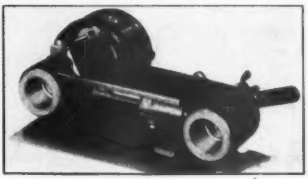

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## SHOP AIDS

*(Continued from Page 71)*

by contour sawing. Section III gives a short resume of machine tools and their direct effect on our standard of living. The book is bound, indexed and covered in textbook style with an added feature which permits the pages to lie flat at any opening. The Handbook is free. Address Continental Machines, Inc., 1303 S. Washington Ave., Minneapolis, Minn.

**"DIE DESIGNING AND ESTIMATING", SECOND EDITION**—The popular "Die Designing", by Charles Bohmer, and "Die Designing", by George Dannes, both out of print, have been thoroughly revised and combined in one volume. About 50 percent new additional material has been added, including groups of classified practical points for Die Designers, Die and Tool Makers. One of these groups on Junior Craftsmanship is of particular value to apprentices and students. Two indexes, one to the Dannes Tables of Time Values, make the new edition convenient for reference. "Die Designing and Estimating", published by American Industrial Publishers at $2.50 postpaid, may be ordered through the TOOL & DIE Journal.


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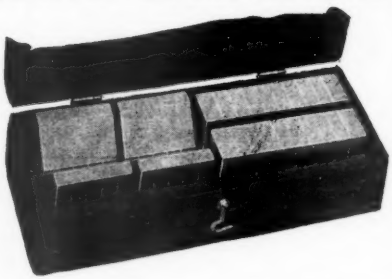

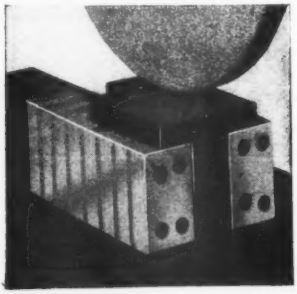

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- Complete information about any product may be had upon request made to the firm listed or to us.
- Your mention of The TOOL and DIE Journal will be appreciated.

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Norton Co., Worcester, Mass. (Behr-Manning Div.)

**ASSEMBLING MACHINES—Automatic**
Sommer & Adams Co., The, 18511 Euclid Ave., Cleveland, Ohio.

**BAND SAWS—Metal Cutting**
Starrett Company, L. S., Athol, Mass.

**BAR STOCK—Heat Treating**
Lakeside Steel Improvement Co., 5418 Lakeside Ave., Cleveland, Ohio.

**BARS—Rolled Composite**
Forging and Casting Corp., Ferndale (Detroit), Michigan.

**BENCHES**
Challenge Machinery Co., Grand Haven, Mich.

**BENDERS**
O'Neil-Irwin Mfg. Co., 315 8th Ave., So., Minneapolis, Minn.

**BLOWERS**
Johnson Gas Appliance Company, 611 E Avenue, NW, Cedar Rapids, Iowa.

**BOLTS—Stripper**
Allen Mfg. Co., Hartford, Conn.
Holo-Krome Screw Corp., Hartford, Conn.
Danly Machine Specialties, Inc., 2121 So. 52nd Ave., Chicago, Ill.
Die Supply Co., 1390 E. 30th St., Cleveland, Ohio.

**BORING HEADS—Offset**
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**BRAKES**
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Danneman Company, F. C., 203 Lafayette St., New York, N. Y.
Die Supply Co., 1390 E. 30th St., Cleveland, Ohio.

**BUSHINGS—Drill**
Universal Engineering Co., Frankenmuth, Mich.

**CALIPERS**
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S. Athol, Mass.

**CAMS**
Gorton Machine Co., George, 1319 Racine St., Racine, Wisconsin.

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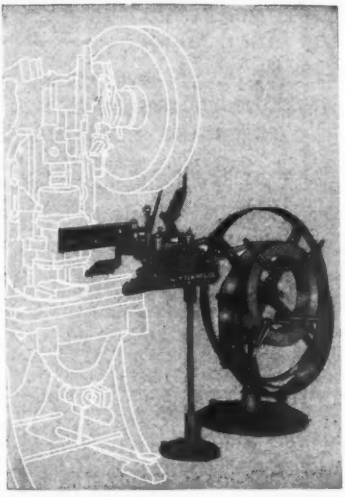

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Acme Industrial Co., 206 No. Laflin St., Chicago, Ill.
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**DIE MAKING MACHINES**
Continental Machines, Inc., 1303 S Washington Ave., Minneapolis, Minn.
Oliver Instrument Co., 1456 Maumee St., E., Adrian, Mich.

**DIE SECTIONS—Composite Steel**
Forging and Casting Corp., Ferndale (Detroit), Michigan.
Jessop Steel Co., 610 Green St., Washington, Pa.

**DIE SECTIONS—Forged**
Ajax Steel and Forge Co., 205 Adair St., Detroit, Mich.

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Danneman Co., F. C., 203 Lafayette St., New York, N. Y.
Die Supply Co., 1390 E. 30th St., Cleveland, Ohio.
Producto Machine Co., The, 990 Housatonic Ave., Bridgeport, Conn.

**DIE STEELS**
Jessop Steel Co., 610 Green St., Washington, Pa.
Ryerson & Son, Inc., Joseph T., Chicago, Ill.

**DIE STOCK**
Masonite Corp., 111 W. Washington St., Chicago, Ill.

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Allen Mfg. Co., Hartford, Conn.
Danly Machine Specialties, Inc., 2121 So. 52nd Ave., Chicago, Ill.
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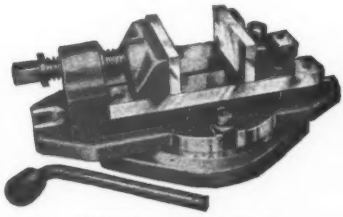

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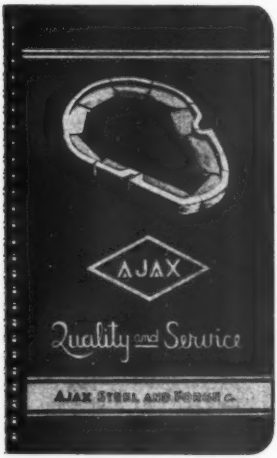


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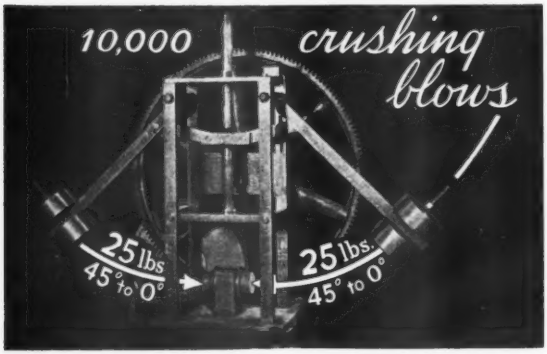


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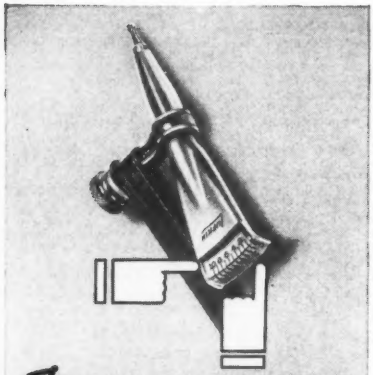

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The enlargement of our die shop allows us to accept a limited amount of small and medium die building.

Tools Dies Molds

Special Machines

*Call MAin 3200*

**HASERODT MACHINE & TOOL, INC.**

1824 Columbus Road Cleveland, O.



**Columbia TOOL STEEL**

MOLITE - 5

*A molybdenum type high speed steel.*

*Carbon ..... .80%*
*Chromium ....4.00%*
*Tungsten .....5.00%*
*Molybdenum ..5.00%*
*Vanadium ....1.50%*

*The all-purpose, heavy duty alternate for 18-4-1.*

*It pays to use Good Tool Steel.*

COLUMBIA TOOL STEEL COMPANY

ARTHUR T. CLARAGE, PRESIDENT

GENERAL OFFICE AND WORKS

810 EAST 14TH STREET • CHICAGO HEIGHTS, ILL.


## ISD Committee Holding Meetings

W. C. STAUBLE, chairman, Industrial Supplies Defense Committee, announces that meetings of this Committee are to be held in approximately forty industrial centers of the United States. Meetings have already been held in Waterbury, Conn., Cleveland, O., Los Angeles and San Francisco, Calif., Denver, Colo., and Chicago, Ill. At the Waterbury and Cleveland meetings approximately 500 manufacturers of equipment, tools and supplies, distributors and users of industrial products were present. Additional meetings are in the process of being arranged. The members of the committee are: W. C. Stauble, Chairman, The Holo Krome Screw Corp., Hartford, Conn.; W. E. Caldwell, The Cleveland Twist Drill Co., Cleveland, O.; A. J. Glesener, A. J. Glesener Co., San Francisco, Calif.; J. Robert Kelley, Manning, Maxwell & Moore, Inc., Jersey City, N. J.; H. H. Kuhn, The Hardware & Supply Co., Akron, O.; H. F. Seymour, The Columbian Vise & Mfg. Co., Cleveland, O.; and A. M. Smith, Smith-Courtney Co., Richmond, Va.

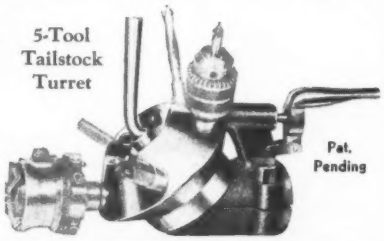
# SAVE TIME ON DEFENSE WORK

Convert your present lathe into a Turret Lathe in 15 seconds by attaching this Turret to the Tailstock Spindle of your engine lathe. Five tools automatically center when brought into play.

*Prompt Delivery*

Free bulletins on this and our other time-saving tools are awaiting your request.

5-Tool Tailstock Turret



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**JEFFERSON MACHINE TOOL CO.**
710 N. W. Fourth St. Cincinnati, O.

*Speed Your PRODUCTION*

30 DAY TRIAL OFFER

BACK OUT BROKEN TAPS *with*

## WALTON TAP EXTRACTORS

Broken pieces are backed out easily and quickly without annealing or drilling or damage to threads. Stock sizes from No. 4 machine screws to 1½" in 2, 3 or 4-flute types. World-wide acceptance for 30 years proves the value of Walton Tap Extractors.

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88 Allyn Street Hartford, Conn.

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SAVES AN AVERAGE OF $4.80 EACH HOUR IT'S USED

Inside and outside cuts on dies, shoes, templets and endless other jobs can be done in a small fraction of the time required by former methods. Saws, files, and polishes. A highly developed, large capacity machine which will enable you to do in minutes jobs which otherwise require hours. Get the complete facts.

*Simply ask for DI-SAW Bulletin.*

**Built by Sawing Machinery Specialists**

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GRAND RAPIDS - MICHIGAN

Micro *Supreme*
**LAY-OUT DYE**

PUT IT TO
## YOUR OWN TESTS

FOR TOOL, DIE, PATTERN OR TEMPLATE LAYOUT ON METAL. A handy five-ounce can sent to you postpaid for . . . . . 60¢

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**GREATER ACCURACY LONGER LIFE**

Shop men who use the ILLINOIS Die Filing Machine know that it turns out work of higher accuracy years longer than ordinary bench filers. Quality construction is evidenced by such features as hardened and ground shafts operating in bronze bushings plus a pressure oiling system. Write for descriptive literature today.

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ILLINOIS DIE FILING MACHINE

**DE-STA-CO ARBOR SPACERS**

They save time in setting up cutters on milling machines and other tools. Will help you get work out quicker. Low in cost, but high in savings. Standard stock sizes from .001" to .125" thick. Also specials up to 4.000".

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Enough spacers for average use on one machine, sent for $1.00. Give arbor size when ordering.

*Price list No. 70 sent free*

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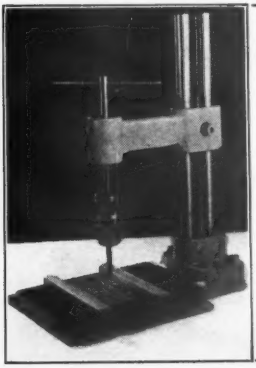
THE Model "SK" Pyro Universal Hardness Tester is a direct reading instrument giving hardness numbers in three standard scales without conversion or reference to charts. This unit, adaptable for Rockwelling or Brinelling, is made by Pyro-Electro Instrument Co., Detroit, Mich.

Several improved features include consistent and uniform reading made possible by a dash pot that governs load application, a plunger system that has been designed to eliminate friction, and interchangeable weights calibrated to 150 KG, 100 KG and 60 KG.

Standard equipment consists of a diamond penetrator, checking anvil, Vee anvil, 3½" anvil, 1/8" and 1/8" balls and chucks as well as two steel and one brass test bars. The unit has a black crystal finish and all working parts are fully enclosed.

**Circular available. Address Pyro-Electro Instrument Co., 10381 W. Chicago Blvd., Detroit, Mich.**



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**SENSITIVE HAND TAPPER**

**for hand tapping of delicate threads in the tool-room, from the smallest up to ¼".**

This handy device is precision-built and jig-bored and will positively eliminate tap breakage or spoiled holes. The lapped spindle and guide assures perfect alignment in any position of the tap. The tapper comes complete with two work-holding jaws, special tap chuck, tap holder block and wrenches.

*See it at the Philadelphia Metal Show, October 20th-24th—Booth No. 262*

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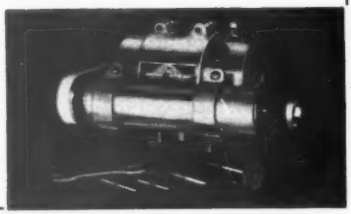
**AT 10,500 TO 50,000 R.P.M.**
**TYPE J-15**

**Designed for Precision Bench Lathes—Equipped with wheels 1/8" to 2½". Other models up to 1 H.P.—speeds 10,500 to 50,000 R. P. M.**



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393 Railroad Ave., E. Rutherford, N. J.

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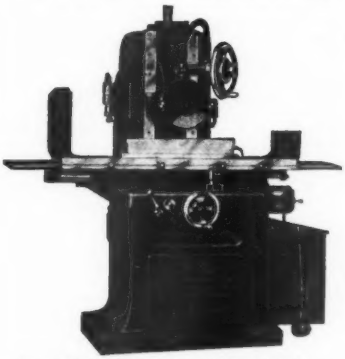
*Speed* and
Precision *Combined*



**IN GRAND RAPIDS HYDRAULIC FEED SURFACE GRINDERS DESCRIBED IN**
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## LATHE DOGS

ARMSTRONG Lathe and Milling Machine Dogs are drop-forged from tough open hearth steel, are heat treated to unusual stiffness. Each is in reality 2 tools in 1 for hubs are large enough to permit re-tapping.

11 types each in from 6 to 14 sizes with Square Head, Headless or Safety alloy steel Screws hardened at the point to prevent upsetting.
*Write for Catalog C-39*

**Armstrong Bros. Tool Co.**
*"The Tool Holder People"*
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Eastern Warehouse & Sales:
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**Move heavy dies, jigs and fixtures more quickly, economically and safely *with the***

# HAMILTON PORTABLE ELEVATING TABLE

(Patented)

**Eliminates costly mishaps and breakage . . . Is a labor saver because it requires only one man to handle . . . Levels and supports overhanging pieces of work . . . Safe — Indispensable — Inexpensive . . . Two standard sizes: 2,000 pounds and 5,000 pounds.**

*Also Special Sizes Up to 20 Ton Capacity*

***Write for circular and prices***

**THE HAMILTON TOOL COMPANY**
Ninth and Hanover Streets Hamilton, Ohio

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**Modern facilities for every type of designing and building service.**

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SPECIAL MACHINES
*Gears—Cams—Precision Specialties*

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TOOLS, DIES, JIGS
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General line of Tool and Die Work, Tool Details, Parker High Speed Grinding Spindles

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*Special Machinery and Experimental Work*

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Swiss Jig Boring
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HIGH GRADE DIES

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***See larger display advertisement also.**

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Modern equipped shop for building of
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Equipment includes:
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Machine Work, Tools, Dies, Fixtures

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*Manufacturers of*
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SHEET METAL DIES, TOOLS, SPECIAL MACHINERY, DIE CASTING DIES
RUBBER MOULDS
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*Modern Facilities*
150-Man Shop

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EXTERNAL CYLINDRICAL
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*TOOLS, DIES, JIGS, FIXTURES*

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DESIGNERS AND BUILDERS OF
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The Cleveland No. 1 Vertical Milling Machine

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Designers and Builders
Dies, Jigs, Fixtures, Gages, Special Machinery
Jig Boring—Planer Equipment

***TOOLS & GAGES, Inc.**
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*"Let us be your tool room."*
DESIGNERS AND BUILDERS
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Ninth and Hanover Streets
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Tools, Dies, Jigs, Fixtures, Special Machinery
The Hamilton Portable Elevating Table

**FLAME HARDENING INCREASES LIFE OF WEARING PARTS**

Flame hardening permits a hard case to be imparted to the wearing surface you desire, locally hardening the objects to the desired depth of hardness, maintaining the proper core structure and no sharp line of demarcation.

Parts of any size or shape can be hardened. There is no appreciable distortion. Chemical composition of the metal is unchanged. The hardened area does not spall off and cheaper base metals can be substituted.

CONSULT OUR ENGINEERS REGARDING YOUR HEAT TREATING PROBLEM.

*Every type of heat treating is available—*

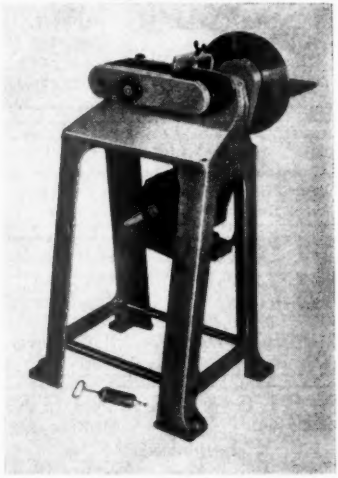
Cyaniding—Carburizing—Chapmanizing—Nitriding
Flame Hardening—Heat Treating and Bar Straightening

The LAKESIDE STEEL IMPROVEMENT CO.

5418 Lakeside Ave. 24 Hour Service Call HEnderson 9100 Cleveland, O.

## Abrasive Band and Disc Grinder Streamlined by Walls Sales

ROUGH grinding on a disc and finish grinding on a band, two operations on a single machine, are now



possible with the Duplex-M, made by the Walls Sales Corporation, New York.

*(Continued on next Page)*

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**ROTARY POWER CUTTERS**

"Ground from the Solid after Hardening"

DESIGNED AND SERVICED BY

**SEVERANCE TOOL COMPANY**

1506 East Genesee Avenue SAGINAW, MICHIGAN

REGRIND TO SAVE TIME SEVERANCE

5000 Shapes and Sizes Grobet Swiss Files

*Write for Catalog YF*

The most complete catalog of its kind. Lists 5000 different shapes, sizes and cuts of GROBET Precision Swiss files.

Learn more about these Chrome Steel Files that have won a reputation for utmost precision and durability.

*Ask also for catalog YM on Files for Filing Machines; catalog YR on Rotary Files and Diesinkers' Burs.*

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Diamonds

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Diamond Tool Company

EXECUTIVE OFFICE 938 E. 41ST ST. CHICAGO ILL. Phone AT. 1095 SHELDON M. BOOTH Pres. LONG DIS. ENTERPRISE 5959

Special Resetting Service TO OUR CUSTOMERS


The entire unit has been streamlined, the drive belt is fully enclosed and the ball bearings are dust proof. An Alemite lubricating system has been incorporated. Adjustment is provided for taking up belt slack and new belts can be installed by means of a new tension release.

The abrasive band measures 4 by 36¼ inches and operates over a working table 5 by 10 inches. The steel disc has a 12-inch diameter. The ½ hp motor provides a speed of 1450 rpm.

**Additional information on the new Duplex-M Abrasive Band and Disc Grinder is available. Write Walls Sales Corp., 97 Warren St., N. Y. C.**


*Have you ordered your copy of "Plastics Mold Designing"? See Page 52.*



TEMPERING · DRAWING

TOOLS, DIES, PRECISION PARTS

Despatch "CF" Furnaces provide accurate, uniform, speedy tempering and drawing and other heat treating processes for tool room, production, and metallurgical laboratory. Equipped for gas or electric heating. Write for Bulletin No. 83 O.

DESPATCH "CF" FURNACE

275° F. to 1250° F.

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MINNEAPOLIS, MINNESOTA



THE HARTFORD "SUPER-SPACER"

For Milling, Slotting, Drilling or Planing Operations—

speeds work output without sacrificing accuracy. Speeds and feeds are limited only by the capacity of the holding means and the power of the machine.

*Write today for Circular CL-2.*

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281 Homestead Avenue

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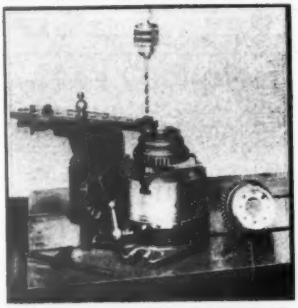

INTERCHANGEABLE BECAUSE
- Precision bored on master plates
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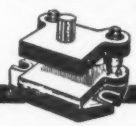


F. C. DANNEMAN COMPANY — 203 LAFAYETTE ST. NEW YORK, N. Y.

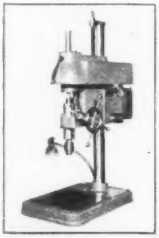
The M-B "SUPER-SPEED" PNEUMATIC GRINDER
*Model S.S.-S.R.*

The ONLY Portable Pneumatic Grinder with Spindle Speed of 100,000 R.P.M.
*Write for Bulletin 1001.*
**M-B PRODUCTS**
132 E. Larned St. Detroit, Mich.

**THE PRECISION UNIVERSAL TOOL HEAD**
brings all adjustments under absolute micrometric control without stopping tool or machine. In Jig Borer, Milling Machine or Boring Mill, it bores, faces, counterbores, turns outside diameters, mills flat surfaces and slots, undercuts, recesses, back faces and does an almost limitless range of "headache" jobs. Send for bulletins.

**Removal Notice:**
We are no longer located at Bridgeport, Conn.
*Send all communications, inquiries and orders to*
**THE PRECISION TOOL COMPANY**
P. O. Box 155, Brooklyn, New York
MAin 4-1064 Cable Address: "PRETOOL-NEWYORK"

**TAYLOR "HI-EFF"**
*Sensitive Drilling Machines*
*Precision Heavy Duty Construction*



Ball Bearing Spindle "V" Belt Drive assures constant spindle speeds of 750 to 4,000 R.P.M., with higher speeds available. Capacities to ⅝" diameter.
*Write for Bulletin.*
**Taylor Manufacturing Co.**
3056 W. Meinecke Ave., Milwaukee, Wis.

## Pioneer Handling Equipment Manufacturer Changes Name

LYON Iron Works of Greene, N. Y., manufacturers of material handling equipment, announce a change in their name to Lyon-Raymond Corp. The business was founded in 1840 by George R. Lyon and was conducted under the management of three successive generations of the Lyon family.

The company has a well-rounded line of material handling equipment including hydraulic lift trucks, hydraulic elevating tables, and other hydraulic equipment.

**VERSATILE!**

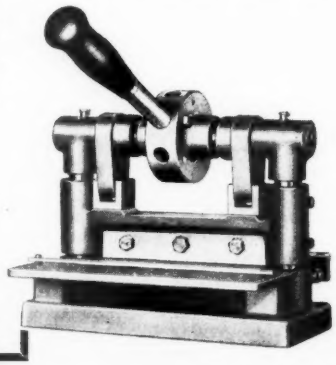
This remarkable little shear cuts steel plate or wet tissue paper. In many cases it substitutes for dies—does faster work at less cost. The latest model

MICRO DIE DUPLICATING SHEAR

has more gauges for greater variety of work. Shearing blades reversible for double life. Shears 24 gauge steel plate 6" wide.

**Write for Circular—**
**"Metal Duplicating without Dies"**

**O'NEIL-IRWIN MFG. CO.**
315 8th Ave. So. Minneapolis, Minn.



## AS YOU LIKE IT

In order to give you exactly what you want, Gerstner Chests are made in over a dozen different styles and in 30 different sizes. Choose your favorite from our Free Catalog.

**GERSTNER TOOL CHESTS**
56 Columbia St. Dayton, Ohio


## New Homocarb Catalog

LEEDS & NORTHRUP COMPANY of Philadelphia have just issued a 28-page catalog, "Homocarb Method for Carburizing". The catalog contains a thorough discussion on heat treating designed for accurate carburizing of such work as gears, spindles, bearing-cones, bushings, camshafts, etc.

A number of representative heat treats are illustrated as well as a number of applications in process. In each case the catalog tells exactly how results were obtained. There are a number of diagrams, charts and photomicrographs. The "Homocarb Method" is said to enable a heat treater to get just the case he wants.

**A copy of this catalog will be sent on application to Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa. Ask for Catalog T-623, "Homocarb Method for Carburizing".**

## Graphitic Steel for Cold Nosing

Graphitic Steel dies being used in a gun shell forging shop are turning in a phenomenal service record. Several of these being used to cold nose 105 mm shells have turned out 50,000 pieces each and still show no appreciable sign of wear. Previously 4,000 impressions was regarded as maximum shell nosing die performance. See ad, Page 10.

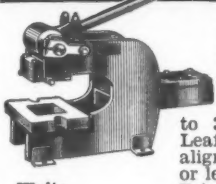
**MARKING SPECIALISTS**
CAN SHOW YOU THE
**QUICK**
WAY TO MARK DEFENSE PARTS WITH NUMBERING, LETTERING AND DESIGN.

MARKING MACHINES, NUMBERING MACHINES, STEEL LETTERS & FIGURES CARRIED IN STOCK OR MADE TO ORDER.

SEND YOUR MARKING PROBLEM AND ASK FOR CATALOG.

**The AcromarK Corporation**
261 North Broad St. Elizabeth, N. J.

LESLIE HAND PUNCH PRESS
**MOST CAPACITY**
POSITIVE ALIGNMENT



Max. cap. 2" dia. hole thru 10 ga. iron, proper shear on punch, throat depth 6". Takes punch press dies up to 3" x 4½" in area. Leaf arm gives perfect alignment without ways or leader pins. Portable. Price $75.00 F.O.B. Chicago.

*Write for Catalog*

**LESLIE WELDING CO.**
2941 Carroll Ave. Chicago

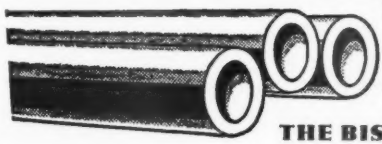
**KNU-VISE TOGGLE TOOLS are used in virtually all phases of industry for holding parts during operations.**

Type KV series with fixed base (illustrated) used extensively in the aircraft and automotive industries where a fast action, inexpensive clamp tool is required.

Send for 24-page catalog describing and giving complete information on the complete line.

**KNU-VISE INCORPORATED**
16841 Hamilton Ave. Highland Park, Mich.

**OIL HARDENING TOOL STEEL TUBING**



Substantially reduces labor costs by eliminating the expensive procedure of drilling from the solid.

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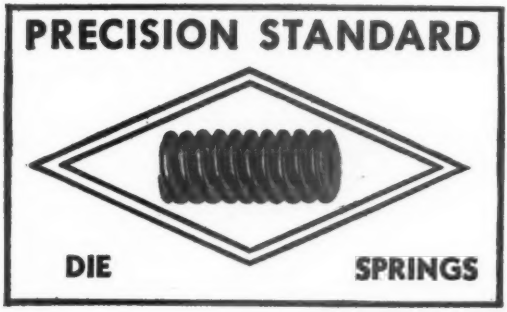


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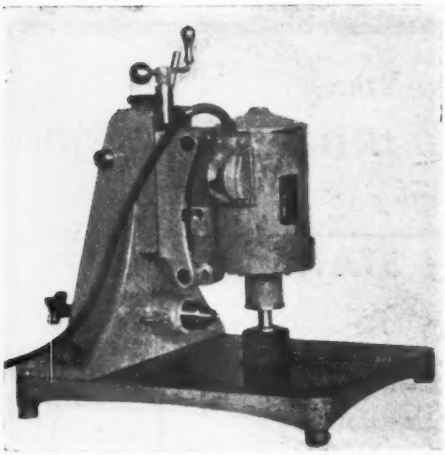

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Use the standard GRINDRITE and the GRINDRITE, JR. for the tough slow jobs like grinding raised edges on punches; grinding out small dies to the line or template; grinding of difficult and odd shapes which heretofore required special, costly set-ups.

Literature on both the GRINDRITE and GRINDRITE, JR. will be sent promptly on request. Ask for Catalog and list of users.

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***Largest Independent Die Builder***

**3601 Humboldt Ave. Detroit, Mich.**

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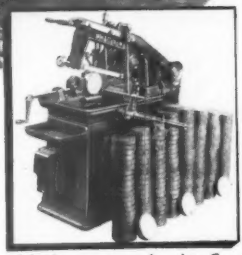

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RACINE Metal Cutting Machines nine abreast in battery formation above are cutting oval tool steel stock four pieces at a time, day in and day out. Such production cutting with close accuracy and minimum blade wear make this Cut-Off Department an economical unit in this manufacturer's production story.

Competition is keen in this field and costs are of prime consideration. Their high cost material must be cut quickly, accurately, and at an acute angle with a minimum of waste. With RACINE Shear Cut positive progressive screw feed saws they needed no guess work in figuring their costs on this operation as each cut is made in exactly the same length of time — guaranteeing production. Uniform accuracy — low blade cost — guaranteed production is *Controlled Cutting* and *Low Cost of Operation.*

**In RACINE'S line of metal cutting machines there is a saw for every size and purpose, 6 x 6 to 14 x 20, hydraulic and mechanical types — standard and fully automatic saws. We will be glad to furnish free metal cutting information applying to your particular material upon request.** ***Write!***

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**For greater cutting efficiency and lower cutting costs, insist on MARVEL High-Speed-Edge Hack Saw Blades and Hole Saws.**

**Buy from your local Distributor**

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